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DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with each copy of this week's issue.

Signalling Enterprise on the L.N.E.R.

THE function in connection with the retirement of Mr. F. Downes from the post of Signal and Telegraph Engineer, Southern Area, L.N.E.R., which we report in our news columns this week, is an appropriate occasion upon which to recall the enterprise of the L.N.E.R. in maintaining and furthering the progressive signalling policy which it has inherited from its constituents. The lock and block system still working at Liverpool Street and installed by the G.E.R. in the early nineties, was the most complete of its kind at the time; when it is replaced, it will be on the lines of the power installation lately put in at Fenchurch Street under the supervision of Mr. Downes. The recently installed power signalling at King's Cross, like that at Fenchurch Street, incorporates colour-lights, which recalls that the first three-position daylight colour-light signalling on a British main line was on the G.C. Section in 1923. The North Eastern Railway was a pioneer of main-line automatic signalling, and the L.N.E.R. has helped in the development of axle counting; one section so equipped is traversed by the Silver Jubilee—a proof of the efficacy of the apparatus with the fastest traffic. A special directional installation of this type is provided at No. 4 platform, Liverpool Street. Lastly, the contribution of the G.N.R. to distinctive semaphore signalling in the somersault arm must not be forgotten.

Railway Working in Blizzards

The severe weather of January in this country was followed by a period of snow and blizzards in the United States during February. Both affected railway working to a degree which was exceptional for the respective countries, though the type of interference with traffic naturally varied. In America, as we see in *Railway Engineering and Maintenance,* heavy snow drifts in the Middle Western States blocked the lines in many places, and were particularly bad in cuttings, where passenger trains repeatedly became stalled. During the two-day blizzard from February 8 to 10, services arriving at Chicago from the west were as much as 24 hr. late, or had to be cancelled. On some double-track sections, attention was concentrated upon keeping one running line clear, and in one case a freight line remained blocked for three weeks. A feature of the clearing operations was the speed with which a return to something like normal schedules was secured after the storms, although road traffic was often paralysed for weeks and left many communities wholly dependent upon the railways for communications and supplies. To minimise the risk of passenger trains becoming buried in drifts before snow ploughs could arrive, shovellers were carried on board. In this country, delay was chiefly due to fallen telegraph poles and lines, and *On Time* records that the gale of January 19-20 in Scotland necessitated the replacement on the L.M.S.R. Scottish system of 300 miles of wire, 36 poles, and 200 cross arms.

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The Week's Traffics

For the past week the increase in the traffics of the four main line companies was £57,000, against £41,000 for the previous week, but the percentage increase in the aggregate receipts to date of the four companies is lower than it was at the end of the 10th week, being 2·69 compared with 2·75. Taking individual companies, the percentage increases on the L.M.S.R. and L.N.E.R. were slightly lower, whereas those of the Great Western and the Southern were slightly higher. Passenger train traffics of the four companies to date show an increase of £66,000 net, to which the Southern contributes £47,000. In the aggregate merchandise receipts, which give a net improvement of £284,500, the chief factor is a gain of £165,000 by the L.M.S.R. Coal class traffics are up £430,500.

	11th Week				Year to date	
	Pass., &c.	Goods, &c.	Coal, &c.	Total	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R. ..	+ 2,000	+ 31,000	− 9,000	+ 24,000	+ 350,000	+ 2·96
L.N.E.R. ..	− 3,000	+ 12,000	+ 2,000	+ 11,000	+ 249,000	+ 2·83
G.W.R... ..	+ 7,000	+ 12,000	− 5,000	+ 14,000	+ 119,000	+ 2·46
S.R.	+ 6,000	+ 500	+ 1,500	+ 8,000	+ 63,000	+ 1·76

The Great Southern Railways of Ireland show an increase to date of £29,979.

* * * *

Manx Amenities

It is at last announced that the homely "tin" footwarmer is to vanish from the carriages of the Isle of Man Railway, where it has held undisputed sway for well over half a century. Next winter, the coaches will be equipped with the familiar low-pressure steam heating apparatus which has been standard on the mainland for so many years. The survival of the footwarmer on the Isle of Man Railway is odd in view of the modernity of that company's vehicles in other matters. We believe that the I.M.R. is the only all-steam railway in the British Isles on which the coaches are universally lighted by electricity. Another good feature of the Manx passenger rolling stock is the complete absence of passenger carriages with rigid wheelbases. A few isolated coaches from the old Manx Northern Railway have Cleminson radial trucks,

but apart from these, all passenger-carrying vehicles are mounted on bogies.

* * * *

Road Motor Drivers' Hours

A decision concerning the hours of work of drivers of road vehicles was given recently by the Divisional Court on a case stated by justices. The respondents were prosecuted for permitting the driver of a motor vehicle belonging to them, constructed to carry goods, to drive, on a named day last year, for continuous periods, amounting altogether to 13½ hours, being 2½ hours more than 11 hours, contrary to Section 19 of the Road Traffic Act, 1930. The only evidence tendered in support of the information was the "current record" kept by the driver as required by Section 16 of the Road and Rail Traffic Act, 1933. This record had been produced to the licensing authority, and was tendered in evidence before the justices by the prosecutor (the appellant in the case), who was one of the Traffic Examiners appointed under the Act of 1933. On objection taken by the defendants, the justices refused to admit this record in evidence, and dismissed the information. In the Divisional Court the three judges were unanimous in the opinion that this decision could not be supported. The document rejected was a record which the statute and the regulations required the respondents to keep and to keep accurately. When they produced it for inspection, as the Act required, they clearly represented that it was correct. If they had not objected to the admission of it, they would have had full opportunity of correcting or explaining it. If it remained without contradiction or explanation it proved the case against them. The case must go back to the justices with a direction to admit the evidence tendered, and to hear and determine the case accordingly.

* * * *

A Silver Lining

In our news pages this week we publish some notes upon the Indian Railway Budget speeches, as presented to the Central Legislature last month. Though on the whole gloomy—depressingly so from the point of view of the locomotive manufacturer and the British market generally—one of the speeches concludes by drawing very favourable comparisons between Indian, British and other Imperial railways on the basis of percentage of net revenue to capital. The following are some of the figures quoted:—

	Earnings per cent. on capital at charge 1933–34	1934–35
Indian Railways	3·40	3·64
British group lines	2·30	2·50
New South Wales	2·62	3·14
Western Australian Government ..	—	3·61
New Zealand	2·05	2·01
Nigerian	3·46*	4·21*
Tanganyika	2·15	3·31
South African	about 3·0	
United States	,, 1·8	

Though these comparisons will probably prove to be more favourable than those for 1935-36, it is well to remember that, in spite of continued deficits, Indian lines are showing reasonable returns on the capital expended upon them. Continuing, one speech states that it should also be noted that, speaking generally, the operating ratios of Indian lines are better than those of other railways throughout the world. Another point to be remembered is that rates and fares in India are cheaper than in almost any other country.

* No contributions made to renewals.

More Fitting Furniture

Second thoughts, they say, are best, and so sometimes are second visits to waiting rooms. In our issue of February 7 editorial comment was made on the waiting room on Platform A of Waterloo Junction, mildly hinting that the furniture was old-fashioned. That is no longer true, for a new suite of chairs and four-seater benches has been installed, made in oak stained to a light brown. The seats are comfortably low, and the backs upright enough to keep the waiting passenger awake. The design of the suite is unpretentious, but avoids extreme severity by means of breaks in the top line of the backs, as the illustration on page 570 shows. Thus this waiting room is now brought up to date, and, turning its back on some miserable other examples of such places, points onward to those even better rooms which will surely come as time and money allow. Rome was not built in one day, so perhaps it is not reasonable to expect all waiting rooms to be improved at once, but this one at Waterloo goes a long way towards heartening passengers whilst they wait not only for their trains but also for somewhere cheerful in which to do the waiting.

* * * *

Railway Ritual

The Folk-Lore Society has recently announced that it is compiling an encyclopedia of superstitions, and from advance details we gather that this will be a useful book of etiquette for the general practitioner in magic. An even more valuable work might, we think, be produced by cataloguing some of the observances still honoured among railway travellers. Certain companies have already circumvented, by means of loud-speakers, one of the most deeply rooted of these beliefs, which is that no reliance is to be placed upon the written word as displayed in stations. Many people for whom a newspaper placard reading "New Aston Villa Sensation" is fraught with deep and even tragic significance, regard far less ambiguous announcements relating to the movement of trains as devices framed by an elfin management on purpose to delude them. Perhaps the Folk-Lore Society will also explain the magnetic influence radiated from many platform tobacco kiosks after the hour of sundown, causing crowds to gather round them in the attitude of adoring but inarticulate devotees at a fairy ring. The uninitiated seeker after matches, who does not care to disturb what is evidently an advanced form of totem worship for the sake of so trifling a purchase, is obliged to have recourse to the less witching slot machine. As there seems little to compel wonder in the average kiosk on its own account, we suppose the attraction to emanate from some object or objects within, but in this we must defer to the riper judgment of the Folk-Lore Society.

* * * *

The Riviera Express

One of the most striking of the European train service improvements planned for next summer is that of the Riviera Express—a *train-de-luxe* which connects Berlin with Nice by way of Basle, the St. Gothard, Milan, and Genoa. A present this train leaves Berlin at 12.50 p.m., and is due in Cannes at 1.45 p.m. the next afternoon. From the introduction of the summer train service on May 15 next, the start will be delayed until 2.20 p.m., but Cannes will be reached only 27 min. later than at present—a gain of 63 min. Of this total nearly half-an-hour is made up by the curtailment of stops, but 19 min. is gained in the running on German metals, and 15 min. in Switzerland. The Swiss acceleration will reduce the running time over the 200 miles from Basle to Chiasso

to 4 hr. 37 min., so that an average speed of 43·3 m.p.h., including stops, will be demanded over the Swiss portion of the route—a remarkable achievement, in view of the ascent of roughly 2,000 ft. from Erstfeld to Göschenen, at the mouth of the St. Gothard Tunnel, and again of 800 ft. from Giubiasco, beyond Bellinzona, up to Rivera. Furthermore, a good connection at Milan will give a through time of 24 min. 40 sec. from Berlin to Rome. This will compete with the quickest night service by the shorter course from Berlin to Rome by Munich, Innsbrück, and the Brenner, which also is to be expedited by 88 min., and will give an overall journey time of 25 hr. 17 min.

* * * *

P.L.M. Accelerations

Among timetable changes affecting the P.L.M. system, which are to come into operation with the summer service on May 15, one of the most important is a new Renault railcar service which is to leave Lyons at 7.15 a.m., and run the 317·3 miles to Paris in 5 hr. (63·5 m.p.h. including stops); this will return from Paris at 6.45 p.m. on a 5-hr. run to Lyons. This is an exact reversal of the previous Bugatti railcar service from Paris to Lyons and back, southward in the morning and back to Paris in the evening, which grew so popular that ultimately it was replaced by a four-coach streamlined steam train. Now the business man of either Paris or Lyons will be able to have a long day in the other city without staying away overnight. Other new railcar services will run between Marseilles and Nice, Vichy and Tours, Lyons and Besançon, and elsewhere. Among long-distance trains to be accelerated is the Simplon-Orient express, which will leave Paris at 10.15 instead of 8.20 p.m., but will have an unchanged arrival time at Belgrade. In this way there will be a gain of 2 hr. from Paris on the throughout journey, and passengers from London will gain 3 hr., as the express will be in connection with the 2 p.m. instead of the 11 a.m. service from Victoria. Several of the P.L.M. services to and from Switzerland and Italy will be materially speeded up; the day *rapide* from Paris to Berne via Vallorbe, for example, will have its time cut by an hour, and similarly in the opposite direction, while Train No. 505 will be accelerated by 55 min. to Milan.

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Special Bogies for High-speed Running

On another page in this issue we publish an article describing the Duplex bogie and its application to main line express coaching stock in the form of the Super-Duplex bogie. An otherwise standard Swiss Federal Railways coach has now been running for about 15 months in regular express service, part of the time on through international trains. Special trials against ordinary stock of various railways have shown that at speeds up to 97 m.p.h. very smooth riding is obtained even after the wheels have run something over 100,000 miles without re-turning the treads. In view of the fact that in future the smooth running of passenger stock at very high speeds will have to receive increasingly careful consideration, the merits of this particular type of bogie, with its free wheels, are deserving of special note, as there is little doubt that the one criticism at present levelled at high speed running is coach oscillation, or, to quote Mr. R. Carpmael, Chief Engineer of the Great Western Railway, in his contribution to the discussion on Mr. Train's recent paper to the Institute of Transport on " Modern Methods of Permanent Way Maintenance ":—

" . . . at speeds of 80 m.p.h. and over, it is impossible to read in the compartment of a coach travelling on straight track if the wheel tyres and flanges are unduly worn, owing to what is termed " hunting " . . ."

Other authorities also agree that the large numbers of coaches required for high speed trains in future will have to be designed—as in the case of the Super-Duplex bogie—to avoid oscillation, or alternatively, abnormally high maintenance charges will have to be incurred to avoid tyre and flange wear at all costs. Incidentally it should be noted that the Super-Duplex bogie appears to show a decided improvement upon standard patterns in economy in maintenance. Reduction of rail wear is also an important point in favour of this special bogie, all wheel slip and much flange wear being obviated by its use, so that even for normal speed services operating economies are assured.

* * * *

Machined Finish

Stress was laid, in the paper read recently before the Institution of Locomotive Engineers by Mr. Vernon Harbord on " Metals and Alloys in Locomotive Construction," on the importance attaching to the careful finishing of all machined parts. Sharp angles or insufficient radii, and any form of sharp break on the surfaces of moving parts, especially those subjected to alternating stresses, will probably form the starting-point of minute cracks which may ultimately lead to complete failure. The higher the quality of the steel—a heat-treated alloy steel, for example—so much the greater are the risks if due attention is not paid to these precautions. Of these risks some striking examples were given, and none more so than the breakage of a straight locomotive axle of which the failure was ultimately traced to the fact that the number and the date of manufacture had been deeply stamped on the barrel of the axle, with the result that a crack had started from one of the figures. Modern practice now requires the stamping of these identification marks on the end of the axle, but the instance is sufficient to show how small a surface indentation may prove the nucleus of a failure. The same applies to the too abrupt bending of steel plates, and the importance of the most ample radii that are practicable at all corners, whether machined or bent, cannot be too strongly emphasised.

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Locomotive Welding 100 Years Ago

The idea of " fabricating " locomotive parts by welding which were formerly produced as castings is, relatively speaking, a recent development, but a fairly casual investigation brings to light instances of welding in locomotive construction over a 100 years ago. It is recorded that the axle guards were welded on the inside frames of some goods locomotives built in 1832, whilst the large 0-6-0 type engines with 18 in. by 24 in. cylinders, built in 1846 by Sharp Bros. for the Manchester, Sheffield & Lincolnshire and the London & North Western Railways, regarded as the most notable six-coupled goods engines of that period, were among the first to have the solid inside frame in one piece, from front to back, with axle guards welded on. This form of framing and construction was regarded as one of the greatest improvements of the period. The late Mr. E. L. Ahrons in his book " The British Steam Locomotive, 1895-1925," records that plain welded sheet iron dome covers were a feature of Kitson practice, being introduced about 1848, and it was from these that the modern dome covers of today were originally derived. These, of course, were relatively only small examples of welding practice, very different in their conception and execution from the elaborate and extensive work undertaken today in locomotive and rolling stock construction, but it does show that from the earliest days welded instead of bolted or riveted connections were known and practised by locomotive engineers.

Iraq Railways

ACTIVITY in the world's grain centres increased both directly and indirectly the earnings of the Iraq Railways during the year ended March 31, 1935. The reductions in passenger fares made in previous years have proved successful, organised motorcar competition on certain sections having largely disappeared. Competition for goods by road motor vehicles has, however, increased. The position has been dealt with by further reductions in rates and increase of facilities, but, in view of the low overhead costs of operating road vehicles in Iraq, the retention of traffic by the railways is difficult. Iranian transit trade is still steadily dwindling. Progress in the construction of the Iranian Railways continues and the greater proportion of traffic for Southern and Central Iran now travels from the Iranian port of Bandar Shahpur. The decision of the Government to close the Euphrates barrage at Hindiya as a bridge to the crossing of trains, involving the isolation of the Hindiya-Kerbala Section, and break of direct rail access to the holy city of Kerbala, has had a very disturbing effect on the traffic of pilgrims visiting the shrines there and has entailed increased working costs. On the other hand, success has attended the provision of a faster passenger train service between Basra and Baghdad, a distance of 569 km., and the passenger route which connects Iraq and Iran with Syria and thence, via Turkey, to the countries of Europe is greatly assisted by this improved service. The fast mail service between Baghdad and Basra is expected to bring an increase of upper class traffic. Third class traffic during the year under review increased by 314,047, or 17·6 per cent. in numbers, and in receipts by 11,334 dinars, or 10·3 per cent., in comparison with 1933-34. Revenue-earning goods traffic improved by 115,243 tons (25·1 per cent.) and by 33,132 dinars (9·02 per cent.). The average haul, however, fell from 341·62 km. to 328·85. Route kilometres open were 1,211, the same as in the previous year. Some operating figures for the two years are compared in the accompanying table:—

	1934–35	1933–34
Passengers	2,112,711	1,799,542
Revenue-earning goods, tons	574,434	459,191
Goods, ton-kilometres	227,430,170	178,299,607
Train-kilometres	2,256,217	2,046,936
Operating ratio, per cent.	89·62	93·89
	dinars	
Coaching receipts	163,139	149,118
Goods receipts	400,442	367,310
Total earnings	572,108	524,037
Working expenditure	512,715	491,986
Net earnings	59,393	32,051

No further allusion is made in the report to the transfer of the railways to the Iraq Government. The report stresses the urgency for the acquisition of diesel engines, and it is considered that units of about 400 h.p. would provide the service required. Single units of this size could operate passenger trains and double units could operate heavy goods trains. Progress in the development of new types is being watched carefully and close touch is being maintained with manufacturers, but some time will probably elapse before the change over can take place. Meanwhile the quality of the water on the southern sections continues to deteriorate. During the long summer months supplies of water have to be carried by train and distributed over a distance of 250 km. on the section Basra northwards. An average of 49 metre-gauge locomotives (including Sentinel coach and motors) and seven standard gauge locomotives were in commission during the year. Reference is made in the report to the extension of mechanical means of accounting and preparation of statistics. With the aid of "Paramount" cards, capable of very rapid sorting, it has been found that operations previously taking two men one month can be performed by one man in a few days. Sand encroachments, south of Ur junction, have become increasingly difficult to contend with, and as the result of a survey a realignment has been found which will not only eliminate the section where sand encroachment is worst but will also place the towns of Nasiriya and Suk-esh-Sheyookh on the main line, shorten the distance between Laqit and Bathah by six miles, and eliminate the expense and inconvenience of the 16 km. Ur-Nasiriya branch.

* The Iraq dinar is nominally equivalent to £1.

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The Licensing of Goods Vehicles

ON reading the first annual reports of the licensing authorities under the Road and Rail Traffic Act, 1933, it is patent that two British industries at least have benefited from the working of the Act. The road haulage industry has been placed on a stable footing, and those engaged in it are able to plan for the future with some measure of confidence. The motor industry must have benefited through the large number of worn-out vehicles that have been relegated to the scrap heap to make way for serviceable units. On both those points there is abundant evidence in the reports. Yet, perhaps, it is not surprising that many users of goods vehicles have been slow to acquaint themselves with their obligations under the Act and even to protect their own interests. The reports, which cover a period of a year and nine months, are not without a touch of humour, as when we read that in the Northern Area the invoking of the co-operation of the chief constables had a livening effect upon the filling-up and sending-in of forms. The East Midland authority, too, refers to the allegation made by A and B licence holders that their legitimate business is being filched by farmers who have Biblical rather than legal notions of what constitutes a neighbour. It is interesting to learn, too, that buyers of secondhand vehicles have been urging the vendors to get them passed by the vehicle examiners—a compliment to the thoroughness of the inspection!

That the scheme of inspection has been necessary is shown by the number of vehicles that, when prohibited from use, have been scrapped because it was not worth while to recondition them, especially when it is seen that the main causes for the prohibitions were braking and steering defects. It is surprising to learn what a large number of A licences are held by operators with but a single vehicle and it is clear that vehicles working under such conditions often suffer sadly from lack of proper maintenance. Some hauliers have yet to realise that the operation of a vehicle in an unserviceable state is in itself a breach of the licence conditions rendering them, as licensees, liable to immediate penalties. With regard to overloading, the Yorkshire authority says there is reason to doubt whether the law relating to dangerous loading is adequate to meet the risk, as risk there must be, run by persons who habitually carry loads which are two or three times heavier than the vehicles were designed to carry.

Two other amendments to the legislation would also seem to be called for. One is to bring trailers drawn by a private car and carrying goods within the scope of the regulations, and another is to provide for the carrying of an identification disc by vehicles authorised under C licences; at present it is difficult to see whether they are properly licensed. In one area considerable difficulty has been experienced in making operators realise that licences are required for motor cycles used for carrying

goods. The keeping of records has proved more troublesome in some places than in others. One or two areas report progress, others fear that drastic action will be necessary to secure improvement. The North Western Authority points out that although there has been little specialisation, recent applications tend to indicate that the sense of security and control given by the Act will encourage haulage contractors to have vehicles specially constructed for the needs of regular customers. The reports, without exception, are informative and instructive, and the Blue Book has a useful index.

* * * *

Transport of Coal

THE PEP (Political and Economic Planning) industries group referred to in last week's issue, recently issued a comprehensive survey of the current problems of the British coal mining industry, in the course of which it reviewed the question of the transport of coal. The group claims that the present system is seriously inefficient in certain respects and suggests that (1) it would be a useful development if all privately-owned coal wagons which become unfit to run were replaced by the railway companies by wagons of a standardised design run on a common user system; (2) so far as possible only 20-ton wagons should be built, and (3), as a preliminary, every encouragement should be given to the pooling of wagons by private owners. These proposals are not novel, as they are based very largely upon the report of the Standing Committee on Mineral Transport which was issued in 1929. This committee recommended, *inter alia,* that the 20-ton wagon should be adopted as the standard and that immediate steps should be taken to secure a compulsory extension of the principle of pooling mineral wagons, a recommendation which, however, was not supported by those members of the committee who were associated with the coal trade. On the other hand, the committee, while visualising that, assuming the financial difficulty could be overcome, the railways might eventually take over the ownership and running of all mineral wagons to the benefit of the community, reached the conclusion that any such action was neither advisable nor practicable at that time.

Many of the statistics quoted by the PEP group are contained in the committee's report and require considerable modification owing to the substantial reduction which has occurred since that date in the stock of coal wagons, while the alteration in the companies' financial position since 1929 renders it extremely unlikely that they would be in a position for some considerable time to contemplate the acquisition of privately owned coal wagons. So far as the introduction of a common user system for all private mineral wagons is concerned, the group advances as an argument that the railway companies would welcome such an arrangement, the statement that the Great Western Railway allow a rebate of 2¾d. a ton for all coal carried in common user wagons. We are unable to find any confirmation for such a statement but, so far as the general principle of common user is concerned, there is, of course, a vast difference between a limited form of common user of coal wagons among a group of collieries situated in the same locality, dealing largely with the same consuming areas, and the general pooling of all coal wagons throughout the country. The amalgamations which have taken place in the coal industry during the last two or three years are undoubtedly facilitating the extension of the former practice, but the general pooling of all wagons, including those belonging to merchants, small factors and industrial concerns dealing with such diverse types of coal and utilising such varying methods of unloading, presents so many practical difficulties that little progress is likely for some time.

With regard to the use of 20-ton wagons, the group suggests that some portion of the Government guaranteed loans should be expended on railway and dock terminals to enable high capacity wagons to be dealt with. It should be pointed out, however, that since 1929, many new high capacity appliances have been provided at ports and, so far as the South Wales docks are concerned, it is considered that the existing 20-ton shipping appliances are capable of dealing with the whole of the present volume of coal exports. The terminal accommodation at a number of stations and large industrial works has also been altered to permit of 20-ton wagons being dealt with, and most new works are being equipped similarly, but very little advantage was taken by colliery companies of the Government's offer of similar assistance for the improvement of terminal facilities. That there are very great difficulties associated with the proposal that new mineral wagons should be constructed only of 20-tons capacity is evidenced by the fact that the recommendation of the Standing Committee upon this point has not yet been implemented. As, however, privately owned wagons which do not bear "G.R." (general repair) plates will not be allowed to run on main lines after December 31, 1937, it is probable that a large number of those nearing the end of their economic life will be replaced during the next two or three years by 12- and 20-ton vehicles built to the agreed R.C.H. specification, with resultant advantages to all concerned.

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Outlying Points

UNDER the title "Remote Control and Operation of Outlying Points," an associate member of the Institution of Railway Signal Engineers, Mr. P. A. Langley, has presented a well conceived and helpful paper to that body, which deservedly received many expressions of approval when it was read on March 11. The railways have not been slow to take advantage of the situation which resulted when the distance limit for power worked points was removed, as many installations described in our columns in recent years testify; so that the subject is one of considerable interest, and its importance is not likely to diminish with the course of time, for the more concentrated working which these installations have made possible has brought financial and other advantages of an attractive kind. Mr. Langley wisely confined himself to certain aspects of the question, excluding some which would require a paper to themselves, such as double wire working and centralised traffic control. Within these limitations, however, he contrived to show the variety of the proposals that have been brought forward for operating points at a greater distance from a mechanical lever than 350 yd. and the ingenuity that has been exercised in devising suitable apparatus and controlling circuits, free from complication and not subject to irregular influences liable to set up dangerous working conditions.

We have travelled a long way technically in the sixty years separating us from the introduction of Annett's key, the forerunner of several key interlocking arrangements seen in many countries, and have seen purely mechanical key mechanism supplemented by electrical apparatus designed to diminsh its rigidity and consequent inconvenience, such as the transmitter of Hepper, introduced to save carrying keys about, or the intermediate siding instrument of Sykes, which allowed Annett's key to be taken on to the station in advance instead of being returned to the station in the rear. The control of sidings by electrical tokens was another phase of this develop-

ment. Electrical control of ground frame levers supplanted the mechanical ground lock in many places, and may be looked on practically as the beginning of the electrical interlocking between levers in the same frame, now becoming increasingly popular in power installations. The application of the electric motor to the operation of points, though first attempted many years ago and apparently a simple matter to the unitiated, has been developed by patient attention to constructional details and circuit design, until a degree of reliability has been reached which must surely leave little, if anything, to be desired today. The earliest successful attempts appear to have been made in connection with all-power installations, with which Mr. Langley's paper was not concerned, and it was found that many new factors had to be considered when reliance came to be placed on batteries, or hand operated generators, as sources of energy, before all requirements could be met satisfactorily.

The amount of thought that has been bestowed on the subject was clearly brought out by the paper, with its numerous diagrams, and the clear explanations given of the advantages or otherwise of the various schemes, under different conditions. There must always be some diversity of opinion on these things, but we imagine that few would be disposed to find fault with the manner in which the points at issue were presented. It is interesting to see how some devices, such as the rectifier, made available to signal engineers only in comparatively recent years, have been applied to give greater simplicity to control circuits without diminishing their safety. It illustrates how the various branches of applied knowledge act and react on each other, and make a practical possibility of a plan which had till then to remain a theoretical ideal. Another point the paper impresses on the reader is the careful way in which mechanism must be adapted to the operating results sought, if satisfaction is to follow. Mr. Langley's analysis of certain typical examples appears to us very sound.

It is almost surprising to see how many possibilities must be provided for, not only in normal working but still more when something unusual occurs. It is well known that it is just at such times that a mistake on somebody's part, made in the anxiety and confusion of the moment, may bring with it the seeds of mishap. Emergency working therefore needs, as Mr. Langley showed, the most careful consideration. Closely connected with it of course, is the question of sound maintenance, without which the best efforts of designer and installer cannot achieve their end. The necessity for an intelligent understanding of the apparatus, and how to keep it in order, is evident, and improved training and educational facilities are being provided to meet it in a way hardly thought of a generation ago. Mr. Langley's paper will itself now help in this good work, providing a source of reference of permanent value on a subject to which the author has plainly devoted much patient study, with which others will be increasingly concerned as time passes.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

The General Purposes Locomotive

London, March 14

To the Editor of The Railway Gazette

Sir,—I have read with interest the editorial article in your March 13 issue entitled "The Modern Mixed Traffic Locomotive." There is, on almost all railways, a wide group of train loads lying between the economical scope of maximum powered engines on the one hand and that of small engines on the other. This group of loadings includes that field in which goods and passenger haulage overlap in terms of engine load-speed capacity: that is to say, where a goods train load at moderate freight train speed can be economically dealt with by the same class of locomotive as can deal with a passenger train load at moderate passenger train speed. The combination calls for a locomotive which has driving wheels of medium dimensions combined with a flexible application of power. For modern requirements along these lines, the four-coupled engine is unsuitable. In other types, experience has shown that not only is the six-coupled engine much easier on the track than the eight-coupled one, but that the internal resistances of a locomotive rapidly augment in intensity as the number of coupled wheels is increased, while its maintenance cost and liability to failure in service follow a similar relationship. Nigerian Railway results for the financial year 1934-35 show that the miles run between failures by groups of eight-coupled engines having driving wheels 3 ft. 7 in. to 4 ft. 6 in. averaged only from 15 per cent. to 33 per cent. of those obtained with six-coupled engines having driving wheels from 4 ft. 6 in. to 5 ft. 0 in.

It is some thirty years since the late Mr. G. J. Churchward introduced a general purposes engine having the 2-6-0 wheel arrangement and 5 ft. 8 in. coupled wheels. Flexibility in power application was secured by a piston stroke of 30 in. combined with a moderate steam pressure. The Great Western Railway has since constructed some hundreds of these engines which have been and are being used for a variety of goods and passenger services, including the haulage of the Cornish Riviera Express west of Plymouth. A somewhat similar design of 2-6-0 general purposes engine having three cylinders was also introduced on the former Great Northern Railway and is used by the L.N.E.R. for such varied purposes as the haulage of coal trains and of the Northern Belle cruising train.

On colonial railways, where traffics are seasonal and where varying weights of rail dictate the use of articulated engines, the further consideration arises that for such engines to realise operating economy to the full throughout the year, they should be of such a design as will ensure them being consistently loaded up to load-speed capacity; it being uneconomical to run such engines under capacity. The six-coupled wheel arrangement in an articulated locomotive provides an engine which is exceptionally easy on the track and bridges, and which in combination with the largest practicable wheel diameter, a long piston stroke and a reasonably high boiler pressure, provides a flexible general purposes engine which can economically and efficiently meet the demands of a considerable range of goods and passenger haulage. The 4-6-2 + 2-6-4 locomotives recently constructed to the requirements of the Chief Mechanical Engineer of the Nigerian Railway are present-day examples of this class of colonial railway engine. Another example is the series of 4-6-4 + 4-6-4 articulated locomotives now under construction for the Sudan Railway.

The statistical engineer of one of the railways of North America—in a paper recently read before one of the railway clubs—ascribed the greater gross-ton-mile costs of some railways to their having overbuilt in maximum capacity locomotives, some of which were in consequence operating below their load-speed capacity with uneconomical results. While a certain number of maximum power engines is required on most railways, the economics of the general purposes locomotive call for careful consideration when new motive power is under review in respect of any railway. This is being recognised in the extensive programme of locomotive construction now being undertaken by the London Midland & Scottish Railway.

G. V. O. BULKELEY,
General Manager, Nigerian Railway

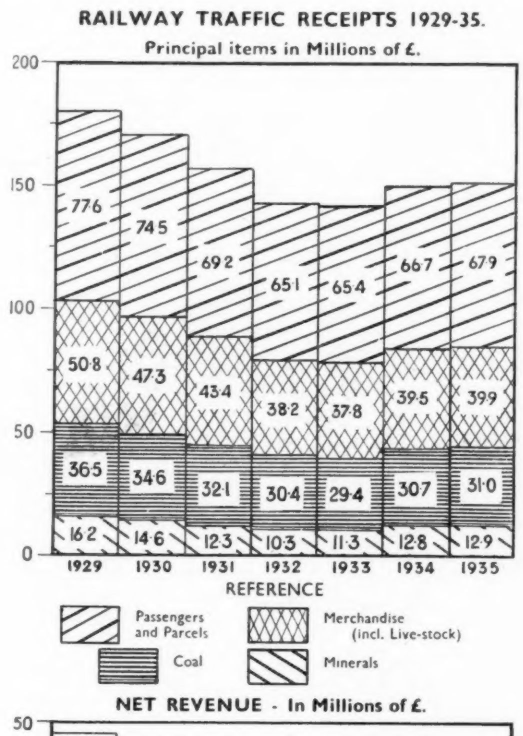
PUBLICATIONS RECEIVED

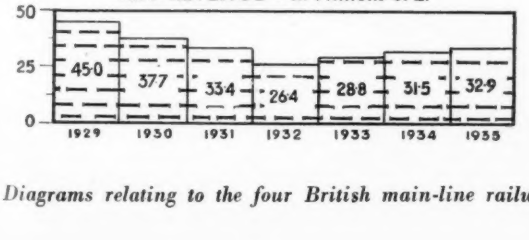
Facts about British Railways, 1936.—No one could fail to glance through this little booklet, issued free each year by the British Railways Press Bureau, 35, Parliament Street, London, without being impressed, as Sir Herbert Walker suggests in his preface, by "the important part played by British railways in the life of the nation." Within the compass of 32 small pages, a wealth of information is given in a concise and lucid form. The total receipts and expenditure for the years 1929-35, for instance, are compared by means of the simple diagrams reproduced below. As will be seen the decline since 1929 and the partial recovery during the last two years are apparent in all classes of traffic. It is to the credit of the railways, however, that the expenditure diagram shows a corresponding measure of economy. This economy is all the more praiseworthy when it is considered how the railways have maintained and, indeed, improved the standard of their services during the slump. Although this booklet is intended primarily for the information of the uninitiated, much it contains may have escaped the attention of those expected to know. Even a railwayman might be excused for overlooking the fact that annual purchases include 11,000 yd. of cloth for uniforms.

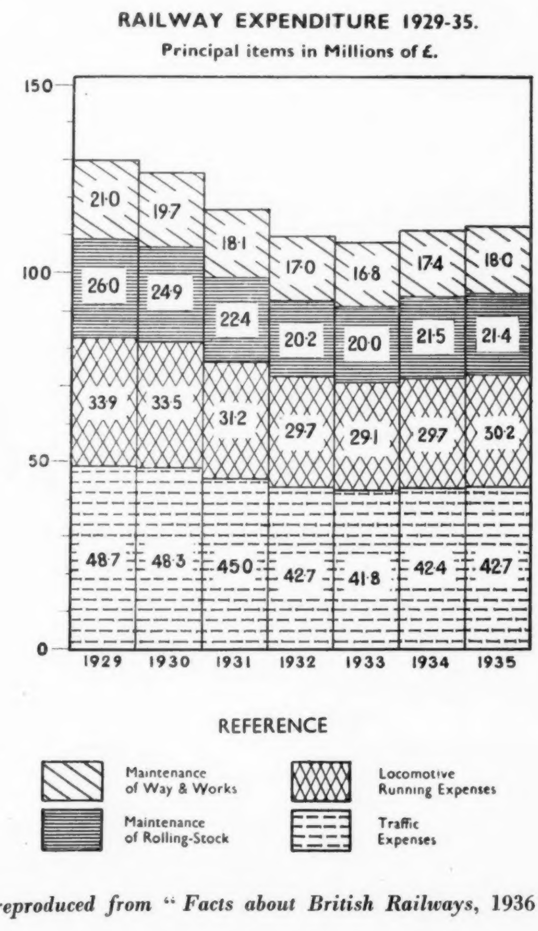
Appendix to the Official Handbook of Railway Stations, &c., 1936. London: The Railway Clearing House, Seymour Street, Euston Square, N.W.1. $9\frac{3}{4}$ in. × 8 in. 262 pp. Price 2s., post free. (The 1929 edition of the Handbook, together with the 1936 Appendix, 10s. 6d.)—Since the last edition of the Railway Clearing House Handbook of Stations was issued, in 1929, many minor alterations have, of course, become necessary; the present appendix arranges the whole of these alphabetically and is, therefore, an essential companion to the 1929 Handbook. Many of the changes have been necessitated by the establishment of the London Passenger Transport Board, and by the closing of a number of minor railways. The formation of the L.P.T.B. results in the former constituent undertakings being referred to under the board's title but with the addition, in brackets, of the initials of the various sections.

Companies whose undertakings are closed include the Bishop's Castle; Campbeltown and Machrihanish (2 ft. 3 in. gauge); Castlederg and Victoria Bridge (3 ft. gauge); Glyn Valley Tramway (2 ft. $4\frac{1}{2}$ in. gauge); Great Southern (Cork, Blackrock & Passage, 3 ft. gauge); Jersey Eastern; L.M.S.R. (Leek & Manifold, 4 ft. $8\frac{1}{2}$ in. and 2 ft. 6 in. gauge); Metropolitan and Great Central Joint Committee (Oxford & Aylesbury Tramroad); Nidd Valley; Rowrah and Kelton Fell Mineral; Sand Hutton (1 ft. 6 in. gauge); Southern (Lynton and Barnstaple, 1 ft. $11\frac{1}{2}$ in. gauge) Southwold; and West Sussex (Selsey Tramway section).

Aluminium Leaflets.—We have received from the British Aluminium Co. Ltd., Adelaide House, London, E.C.4, a set of three leaflets dealing with aluminium foil, aluminium ingots and billets, and aluminium alloy wood screws. The distinctive qualities of aluminium are exemplified in the light weight combined with high tensile strength (26-28 tons) of the aluminium alloy screws, and in the quantity of foil per lb. of aluminium as compared with a like weight of tin or lead foil. The ingots and billets are supplied in a variety of standard forms, illustrated in the leaflet, including half-round sticks, wire bars, and round billets.







Diagrams relating to the four British main-line railways, reproduced from "Facts about British Railways, 1936"

THE SCRAP HEAP

As a result of negotiations between the Railway Clearing House and the R.S.P.C.A., the railway companies of Great Britain have agreed that drinking water shall be available free of charge for dogs accompanying travellers.

* * *

At a recent railway meeting a shareholder said: "It has become as customary for a company director to carry proxies as for an American gunman to carry a gun."

* * *

THE RAILWAY BOOM OF 1836

The Times of Wednesday, March 2, 1836, recorded that there had been presented to the House of Commons that year 57 petitions for railways, involving an estimated outlay of upwards of £28,000,000 sterling, founded on which 32 bills had been read a first time; to the petitions had been affixed names of 36,978 assents, 6,575 dissents, and 7,475 neuters.

House of Commons.—Monday. The sheriffs of the city of London appeared at the bar to present a petition from the Lord Mayor, Aldermen and Commonalty of London, in Common Council assembled, against the proposed railways in the city of London. —*From the "Sunday Times" of* March 13, 1836.

* * *

After having been 11 days without food, a man in the last stages of hunger, thirst, and exhaustion was taken from a railway truck at Besançon recently, when the seals were broken after its 350-mile journey from Rouen. He was a 50-year-old docker who generally slept on the quays, but, seeing a comfortable railway truck on a siding near Rouen station, he got in, and went to sleep, only awaking to find himself going for a train ride. At every stop, he banged on the sides of the truck and called for help. None came, and soon he was too weak even to call. When he was delivered, moaning faintly, he was just able to plead for water

* * *

SKUNKS FOR TRAIN STOPS

Among inventors who have volunteered from time to time to make the railroads safe for democracy was one who proposed to utilise skunks for automatic train stops. If you don't believe me, obtain permission to examine the archives of the Signal Section of the American Railway Association. One driving wheel of the locomotive was to be removed and in its place was to be an elliptical wheel, so that the engine would hobble along like a man with a short leg, so long as the track was clear. In such circumstances the skunk was expected to behave like a gentleman. I should have explained that the animal was to be confined in a narrow cage directly in front of the engineer's face, with its head—the skunk's head, you understand—toward the front. Skunks hate to ride backward, you know. Well, suppose you came to a signal to stop, and the engineer disregarded it. That elliptical wheel would get in its deadly work, tripping a trigger which would release a spring which would cause a rod to prod the skunk in the short ribs. Quite properly, the skunk would regard this as a personal affront and—and—well, a skunk knows how to resent an insult. If the engineer did not stop after that, he deserved anything that happened to him.—*From a lecture on "Vagaries of Railroad Evolution" given to the Rochester (New York) Engineering Society on February 10, 1928, by Mr. Charles Frederick Carter of the New York Central Railroad.*

* * *

A very unusual L.M.S.R. animal known as *Bob* was a dark brown shunting horse of Bletchley. *Bob* used to light the incandescent gas lamp at the bottom of the platform slope. After operating the tap with his neck he would carefully look round to see that the lamp was alight, afterwards wagging his tail with apparent satisfaction. It was left to *Ginger*, another Bletchley horse to provide an excellent example of "horse-sense." A great favourite with the travelling public, *Ginger*, on one occasion, was pulling a load of cattle off one of the Banbury trains when he fell down between a locomotive siding and the down fast line, pulling his driver with him. An express was approaching at the time. The animal had the presence of mind to roll over on his back, shoot his legs in the air, and remain in that position until the train had passed, saving his own life as well as that of his driver.

* * *

Clergymen get a kick out of railway timetables, say H. A. VALLANCE, Hon. Sec., H. W. BARDSLEY, Hon. Librarian, of the Railway Club, founded 1899, possibly world's only club for railway amateurs with permanent always-open premises. Membership list of more than 100 has simultaneously included peer and engine-driver, is difficult to break into. Bardsley looks after club's collection of Bradshaws, one of the best in the world. It dates back to 1845. Publishers offer £100 for copy of first Bradshaw Guide of present size, published December, 1841. Only one I know of is in the Bodleian. Librarian Bardsley is not interested in engines; but he has fine collection of railway tickets going back to 1832, is particularly proud of very old Midland Railway 2nd class Derby—Nottingham season. Vallance, civil engineer, is specially interested in Scottish railway history.—*From the "Daily Express."*

* * *

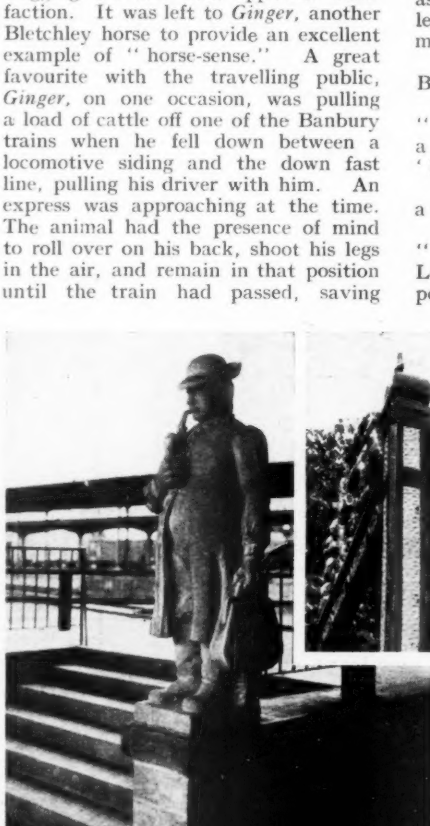
The slow cross-country train was already three-quarters of an hour late, and there were indications of a further loss of time, weather and traffic conditions being very bad. Arrived at a small junction station, one passenger asked of another: "What do the letters on that luggage van over there mean—L.P.T.B.?"

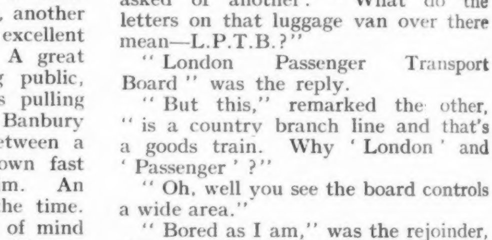
"London Passenger Transport Board" was the reply.

"But this," remarked the other, "is a country branch line and that's a goods train. Why 'London' and 'Passenger'?"

"Oh, well you see the board controls a wide area."

"Bored as I am," was the rejoinder, "I should not confuse *this* with London or *that* with passenger transport."





Above: A station sign at Schramberg, Black Forest. The small boy clings to his mother's dress, while father follows with heavy luggage. In this part of Germany woodcarving is a traditional art, and the sign is one of several, beautifully carved and then painted brightly. Left: Quaint figure at the entrance to Altenburg station, Thuringia

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Economy Measures: Railway Amalgamation

In a statement recently placed before the Legislative Assembly, Sir Zafrulla Khan, Member for Railways and Commerce, dealt with the measures of economy suggested by certain committees but not so far adopted.

The question of regrouping the State Railways into a smaller number of systems was one of the recommendations of the Pope Committee, which the Government had had under consideration for some time. A cut motion on the Railway demands for grants was carried in the Assembly in order to express the views of the House in favour of railway amalgamation. Sir Zafrulla Khan stated, in this connection, that the Government stood in principle committed to amalgamation. He mentioned a scheme of regrouping which might be feasible in adoption. The broad gauge sections of the B.B. & C.I. and G.I.P. Railways could be run as one. On the other hand the A.-B.R., the metre gauge section of the E.B.R. and a portion of the B. & N.W.R. might come under one or two administrations. The broad gauge portion of the E.B.R. could be brought under the E.I.R. and the South Indian and the M. & S.M. Railways could be amalgamated. The N.W.R., being already too big, could not take on additional mileage. Some of these combinations presented no great difficulty while others had to be carefully considered: the main obstacle lay in the fact that some of the railways were still under company management.

Economy in Working Expenses

The Railway Sub-Committee of the Retrenchment Advisory Committee of 1931 made certain recommendations in regard to economy in working expenses which had not been carried out. The Railway Member explained that the recommendation for the abolition of the posts of Controller, Deputy Controller and Assistant Controller of Railway Accounts and for the creation of a post of Deputy Director, Railway Accounts, in the office of the Railway Board had been discussed with the Auditor General and the Public Accounts Committee and found unacceptable.

The Railway Board had also examined the sub-committee's recommendation that the headquarters organisation of railways, with divisional organisations, should be cut down considerably. It was decided to leave the consideration of the matter over till the expert inquiry into Indian railways was instituted. The proposal for an expert committee was subsequently dropped and the Pope Committee appointed instead. Although the Pope Committee did not officially consider this question, Mr. Pope, on an unofficial reference, expressed the opinion that, on general organisational principles, it would be a mistake to reduce the executive and supervisory machinery on important railways. The question was not, therefore, proceeded with further. The sub-committee's opinion on the personnel section of certain railway administrations was still under consideration.

Railway Publicity Expenses

The sub-committee recommended that the expenditure on publicity should be reduced to Rs. 2½ lakhs, a figure less than half the expenditure that was being incurred at the time. This was considered in consultation with the railway administrations, but it was not found possible to cut down the expenditure to a figure below Rs. 7·70 lakhs. The matter was, however, being further examined.

Leave Reserve of Officers

In regard to the recommendation that the leave reserve of officers should be reduced from 20 per cent. to 10 per cent., the Railway Board, after careful consideration, had decided to reduce the leave reserve of 20 per cent. (which included deputation reserve) to 16 per cent. It was not considered possible to make any further reduction. The Government had still under consideration the proposal that the concessional rates and fares granted to the military department should be discontinued.

Continental Locomotives for India

The orders placed with Krupps in 1935 for 29 XT class locomotives for the East Indian and the North Western Railways formed the subject of a recent question in the Legislative Assembly. The Railway Member explained that the XT 0-4-2 class tank locomotive was found to be most suitable for running frequent services of light and fast trains in competition with road traffic. Trials carried out between this class and the next most suitable class showed a saving on the XT class of Rs. 4,042 per engine per annum on the North Western Railway and of Rs. 2,325 on the East Indian. These purchases were sanctioned after full consideration of the present financial position and the existing rolling stock available. Unsubstantiated allegations against both Continental and British manufacturers had been received, which the authorities had ignored. The price factor was one of the most determining considerations in placing the orders.

Colliery Fire Necessitates Diversion of Traffic

A serious underground fire broke out on January 30 in Bird & Company's Loyabad colliery in the Jharia area. In a violent explosion that followed, 5 European and 32 Indian employees were killed. Control operations were very dangerous and the affected shafts had been sealed. In consequence of the fire, all trains on the Jharia Chord main line of the Bengal-Nagpur Railway had to be diverted to the Grand Chord between Bhojudih and Mohuda. Shuttle services were also introduced between Loyabad and Mohuda and between Kirkend and Bhojudih to connect with through passenger trains. The Government of India have convened a meeting at New Delhi to consider the question of dealing with colliery fires.

NEW ZEALAND

Bright Prospects for Railcars

The new Minister for Railways, the Hon. D. G. Sullivan, said in a recent interview that he had already presented a short report on railcars to the Cabinet, and that he considered sufficient information was available to justify placing additional orders for them at an early date. He believed that in the railcar the Government had a means of rejuvenating the railways and of enabling the system to hold its own with other forms of transport, including in some degree the competition of air services. He also explained that with the proposed railcar service it would be possible to give 200,000 miles additional service to the public at the same or slightly lower cost than the present service. As far as was practicable the cars would be manufactured at the Hutt workshops, but mechanical parts would have to be imported.

It appears probable that the experimental type of car now in use by the department will be standardised for the additional services contemplated between Wellington and New Plymouth, 251 miles, and from Wellington to Palmerston North via the Wairarapa route, 130 miles. As noted in The Railway Gazette of June 28 and September 27 last, a number of these cars is already under construction, Leyland Motors Limited supplying the engines and torque-converters.

East Coast Railway

An inspection of the East Coast extension—to connect the north-eastern section of the North Island system, at Gisborne, with the existing Wellington-Napier line—has been made by the Minister of Public Works, and it appears that this 150-mile line, after many vicissitudes, is to be completed at last. Over £3,500,000 has been spent on the line to date, and approximately £140,000 a year is paid in interest on this money, so that since the work was stopped it has cost some £500,000 in interest. One year's interest alone would have completed the line from Napier to Wairoa (83 miles).

It was found that the part which had been completed between Napier and Gisborne had fallen into disrepair to such an extent that it will cost between £50,000 and £100,000 to rehabilitate it. There have been many slips, and rails and sleepers have rusted and deteriorated. In addition, this portion of the line suffered considerably in the

Napier earthquake of 1931. When the construction work is properly under way it will absorb 1,000 men. Additional rolling stock, including railcars, to work the line, is estimated to cost £130,000.

ARGENTINA

Proposed State Railway Extensions

A decree recently issued by the Ministry of Public Works authorises the expenditure of $36,560,000 paper on the completion of a number of lines, the construction of which was begun some years ago, but was subsequently suspended owing to lack of funds; and also on the construction of several new branches, in addition to the purchase of rolling-stock and materials. Details of the various schemes are as follow:—

Lines to be Completed	$ (Paper)
Pie de Palo to Mendoza	4,000,000
Salta to Socompa	1,000,000
Embarcación to Yacuiba... ...	300,000
Leales to Termas de Rio Hondo...	250,000
Federal to Curuzú Cuatia ...	200,000
Federal to Concordia	350,000
San Antonio to Viedma and Nahuel Huapi	600,000
Total	$6,700,000

Projected New Lines	
Joaquin V. Gonzalez to Pichanal	4,500,000
Campo Gallo to the north ...	500,000
Tostado to General Pinedo ...	2,500,000
Milagro to Quines	860,000
La Paz to Feliciano and San Jaime	1,330,000
Various surveys	100,000
Total	$9,790,000

Of the $20,000,000 balance, $2,000,000 has been allocated to track renewals and maintenance; $8,890,000 to buildings and installations; $3,700,000 for secondary branch lines and industrial sidings, $4,470,000 for rolling stock, and the remainder for river protection schemes and other subsidiary works.

The Salta-Socompa Railway

The only two of the above schemes calling for any special comment are those for the lines from Salta to Socompa, and from Pie de Palo to Mendoza. The Salta-Socompa line, which has been referred to at various times in The Railway Gazette, is the Argentine section of the international railway intended to join up some day with another line from Antofagasta. The scheme, previously known as the Huaytiquina line, has had a chequered history on both sides of the Andes, but especially in Argentina, where the reckless squandering of many millions of public money upon it to little purpose, by successive governments—chiefly during the Irigoyenist regime—has gained for it an unenviable notoriety. The line was begun as long ago as 1907, but the private concessionaire was unable to fulfil the contract, and the concession was declared to have lapsed in 1914. Construction was resumed in 1921, but when the work was again suspended at the beginning of 1931, the line had only reached San Antonio de los Cobres, 122 miles from Salta, considerably less than half the 320-miles distance from Salta to Socompa, and the cost of construction is roughly estimated at £70,000 a mile. The line runs through a region with few or no industrial possibilities and is of no tourist interest, so that on all grounds, it would seem to be sound policy for the Argentine Government to abandon this unlucky venture once and for all, and instead, devote a portion of the funds allocated to it to some really useful purpose.

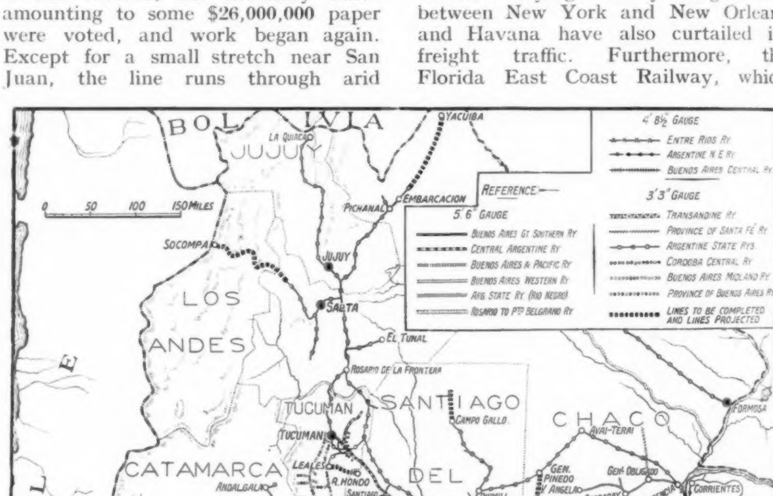
The Pie de Palo-Mendoza Line

This line is another example of ill-contrived railway construction on the part of the State, both because of its uselessness, and also because it gravely prejudices the interests of the B.A. & Pacific Railway, to whose San Juan-Mendoza branch it runs parallel practically throughout its length. As Lord St. Davids pointed out in his speech to the shareholders of the company at the last annual meeting, when the line was first projected about four years ago, the company protested to the Government against the scheme, which was thereupon dropped, apparently for good. Some two years ago, however, it was revived, the necessary funds amounting to some $26,000,000 paper were voted, and work began again. Except for a small stretch near San Juan, the line runs through arid country, incapable of irrigation and therefore unproductive. Obviously, the only way in which such a railway can be made to pay is by diverting traffic from its private rivals by the unfair practice of rate-cutting. [These and most of the other proposed lines are shown on the sketch map below.—Ed. *R.G.*]

UNITED STATES

The "Oversea" Railway

The famous Flager "oversea" railway line which runs, mostly on bridges and embankments, for 128 miles over the Florida keys from Homestead to Key West—the port for Cuba—was severely damaged by a hurricane last autumn. It has not been in operation since, and, as already announced, may be abandoned altogether. It is estimated that approximately £400,000 would be required to restore the line to service, and in recent years it has not enjoyed much patronage. Aeroplanes operating between Miami and Havana have deprived the line of much of its passenger traffic, and "sea train" ocean vessels carrying railway freight cars between New York and New Orleans and Havana have also curtailed its freight traffic. Furthermore, the Florida East Coast Railway, which



Map showing the positions of the principal Argentine State Railways extensions to be completed or projected

owns the "oversea" line, is being operated by receivers and is barely earning its working expenses and taxes. The receivers have been unable to borrow funds to restore the line, and, unless the bondholders elect to advance the funds, it is unlikely that the restoration will be undertaken.

The T.V.A. Decision and the Railways

The decision of the Supreme Court in the Tennessee Valley Authority (known as the T.V.A.) case may have important consequences to the railways in augmenting the competition of water transport. The Court approved the sale by the Federal Government of electric power, generated incidentally to its damming of the Tennessee river, to improve navigation—a recognised federal function. Since the Government is zealous in its policy to extend the development of hydro-electric power, it is to be assumed that many streams will be looked on as worthy of improvement for navigation; and waterborne commerce will consequently increase, since no tolls are levied on users of improved waterways. As one opposition newspaper has characterised it: "'Cheap' power to be provided by extravagance in construction of inefficient transportation, and the whole product to be used in predatory competition with the business of private citizens!"

SWITZERLAND

New High-Speed Trains

At a meeting on March 5 the Administrative Board of the Swiss Federal Railways allowed the General Management a credit of Fr. 1·2 million for the purchase of two electric high-speed lightweight trains, which are to be placed in service by the spring of 1937, in pursuance of the Federal Railways policy of improving and accelerating their passenger services. The new trains are to be designed for a maximum speed of 150 km. (93 m.)p.h., and are to comprise two motor coaches and a trailer between them. The latter will contain compartments for baggage and mails, and the total seating capacity of the train will be 30 second and 184 third class passengers.

Reductions on Season Ticket Prices

The General Manager was also authorised to propose a reduction on general season tickets. Details were settled at a commercial conference of the various Swiss transport undertakings, which took place on March 6. The new rates (in Swiss francs), which will come into force on April 1, are:—

	First	Second	Third
3 months	500	400	300
12 months	1,500	1,200	900

Holders of general season tickets may, after April 1, travel by express trains without paying the usual surcharge. The rates for tickets entitling the holders to travel at half fare have also been reduced, and a single type of ticket will henceforth be used which will be valid for all three classes, at the following rates: 3 months Fr. 70, and 12 months fr. 220. In their announcement of these concessions, the Federal Railways draw attention to the considerable timetable improvements which will take effect on May 15 (to which reference was made in THE RAILWAY GAZETTE of January 24, pp. 141-2), and to the arrangement recently made with the Swiss taxi companies and a number of garage-owners, whereby general season-ticket holders may hire cars, with or without chauffeur, at greatly reduced rates.

Other matters discussed at the meeting of the board were (1) the effects of the 1936 financial programme on the railway financial position, (2) a report to be addressed to the Federal Post Office and Railways Department regarding the popular "initiative" purposing to safeguard the Federal Railways from political influences, and (3) a second report to the department concerning the revision of the Federal Railways Laws.

Discontinuance of the "Asto" Services

As a result of the rejection of the Bill for the division of traffic (generally known as the "Rail-Road Bill") on May 5, the Federal Railways have found it necessary to discontinue the door-to-door service or "Asto." It was suspended on several lines as from March 1 and the remaining services will cease by May 15 at the latest. When the "Asto" services were first introduced, the Federal Railways expected that the additional expenses incurred by these arrangements would be balanced by an increase in long-distance freight traffic, which would be given up by the road transport concerns. As these hopes have not been fulfilled, the Federal Railways, with the co-operation of the Post Office, are trying out as an alternative plan the arrangements referred to on page 11 in the January 3 issue of THE RAILWAY GAZETTE. The results have been so satisfactory up to now that extensions are anticipated.

JAPAN

Improved Kobe-Osaka Traffic Facilities

The steadily increasing passenger traffic between Osaka, the industrial centre of Japan, and Kobe, port and trade centre, have necessitated the provision of additional transportation facilities. The traffic between the two cities is served by the Government Railways electrified main line, by the Hanshin and the Hankiu Light (4 ft. 8½ in. gauge) Railways, both electric, and by an electric tram and bus service along the main road, five services in all. The Government Railways now maintain a service of two non-stop and six all-stations trains an hour both ways, in addition to the long distance main line trains, throughout the day over their 3 ft. 6 in. gauge main line; the Hanshin Railway operates five non-stop and eight all-stations trains an hour, and the Hankiu Railway ten non-stop and twenty all-stations trains an hour. The journey takes 25 to 50 minutes for the 18 miles between the two cities. There are equally frequent services along the tram and the bus lines.

Extensions under Construction

To cope with the increasing traffic, the Government Railways administration is quadrupling the Nada-Kobe section as mentioned on page 1206 in THE RAILWAY GAZETTE of June 21, 1935, thus providing four tracks from Osaka to Kobe throughout. The Hanshin Railway is extending its double track line by removing the Kobe terminus from the suburbs to a site adjacent to the Government Railways Sannomiya station in the city. The extension, about 2 miles long, is carried on reinforced concrete viaducts for the greater part of the distance. The Hankiu Railway terminus in Kobe is an underground station near Sannomiya; an underground extension, about 3 miles long, to the west end of Kobe is under construction. All these works are expected to be ready for service in 1937.

Train Blown Over

Strong blizzards recently blocked long stretches of the track with snow, in some places as much as 6 ft. deep on the Ou main line in the northern districts of Honshu, the main island. A Tokyo-Aomori express was marooned in the snow for over twelve hours. A passenger train consisting of an engine, three carriages and a van, on the branch line from Kawabe to Odose was blown over near Ajigasawa station where the line closely follows the coast. There were no fatal results, but over 50 passengers were injured. The Government Railways have an efficient storm warning service on exposed lines, but at the time of the accident the registered wind force was well below the danger limit; it is believed that an extra strong gust caused the accident.

Train Fire Causes Fatal Accident

An unusual accident, with fatal results, occurred near Fukui on the West Coast main line in the afternoon of January 14. A messenger boy took on the train, in defiance of the regulations, a tin of petrol wrapped in a cloth, lit a cigarette and dropped the match on the cloth, which was soaked with petrol. An explosion resulted, the carriage took fire, and before the train was brought to a standstill by applying the emergency brake, the carriage was ablaze from one end to the other. About 50 school children were travelling in the burning coach; most of them managed to reach the adjoining carriages through the corridor connections, but four girls were burnt to death and ten others were seriously injured. The boy who caused the accident also caught fire, he jumped off the train, extinguished the flames by rolling in the snow, and decamped. He was traced and put under arrest.

RAILWAY POLICY AND OTHER MATTERS

Some extracts from the Chairmen's speeches at the recent railway meetings

Locomotive Coal Prices

In the month of January we were, in common with the other companies, approached by the representatives of the coal trade with a request that we should agree to a voluntary increase of 1s. per ton in the price of coal under our existing contracts, in order to assist in the granting of an increase in wages to the miners. This request we felt bound to decline since the increase must have constituted a direct reduction from the dividend fund, already far too low, but it is unfortunately true that we shall be able to make new contracts only on the basis of an additional shilling per ton, which in a full year will increase our coal bill by about £230,000.—*Mr. William Whitelaw at the L.N.E.R. meeting.*

L.M.S.R. Locomotive Policy

I will not apologise for referring again to our locomotive policy and the more intensive use of engines, but 1935 has seen the fruition of earlier preparation in some striking changes. I told you last year that as a result of reorganisation in many directions the numbers had come down from 10,316 at amalgamation to 8,000 and they are now 7,885, the types going from 393 to 206 then, and now 185, and when all orders in hand are completed the number of types will fall to 150 and the stock to 7,554. It must be remembered that the train miles increased by 2¾ millions. We have obtained a further increase of 5 per cent. in the average mileage per engine in use. The more powerful engines have enabled us to reduce double heading for passenger trains by over 20 per cent. in the year. The chief contribution to these improved operating results is the policy of new construction, improved methods of scheduling engine workings, modernisation of sheds and the concentration of running repairs. With the greater work performed by locomotives it is gratifying to find that there was an actual reduction of 19 per cent. in locomotive casualties, the number being the lowest recorded by the L.M.S.

Our locomotive policy needs no more extended justification, but you may be interested if I pass on to you a comparison made on high authority. From 1931 to last September 793 new steam locomotives were put into service on the L.M.S., with its route mileage about 7,000, and this exceeded the number of new locomotives of all kinds, steam and electric, put on the United States railroads with a route mileage of 250,000 in the same period.—*Sir Josiah Stamp at the L.M.S.R. meeting.*

Possible Closing of some South Wales Ports

In addition to the loss of export trade, our dock undertakings have suffered through restrictions on imports, and the total imports and exports at our South Wales ports in 1935 were 411,000 tons less than in the previous year, the decrease compared with 1929 being no less than 13,523,000 tons. A sum of over £21,000,000 has been expended on our docks in South Wales in purchase price and capital expenditure since we took them over. They have been modernised throughout since 1921, but the net revenue from them last year was only £46,682—£42,000 less than in the previous year, and £496,849 less than in 1929. An important element in the financial results of the docks is the payment made by us in respect of rates and rate relief, which last year amounted to £208,000, as compared with £170,000 in 1929, and £100,000 in 1913. This large increase is, in our opinion, quite unjustified, and we anticipate a very substantial reduction for the current year in view of the present level of our earnings on the undertaking. The position in regard to rebates from dock charges is somewhat similar, in respect that reductions must be anticipated also in this case.

The volume of trade now being dealt with at these docks is far below their capacity, and although the fall in revenue has been offset to a considerable extent by economies, we are approaching the limit to which expenditure can be reduced without affecting the efficiency of the several undertakings. In our view a grave question now arises as to whether the maintenance of so many docks in South Wales can be justified, even on the ground of public interest, and unless there is a substantial increase in the export trade in the near future, or a higher scale of dock charges, we shall have no alternative but to ask Parliament to sanction the concentration of the traffic at fewer ports. The figures which I have ventured to give you in some detail indicate the grievous conditions by which South Wales has been afflicted, due to causes which you will see are entirely extraneous, for which nobody could be held responsible, and with which no board of directors or management could possibly contend. They deserve the anxious deliberation of the Government and give South Wales an irresistible claim to special consideration in connection with the establishment or extension of any works of national concern.*—*Sir Robert Horne at the G.W.R. meeting.*

Prospects for the Dover Train Ferry

I told you last year of the structural difficulties we were having with our train ferry dock at Dover. These were happily overcome in the past year, but the overcoming of the difficulties added largely to the expense of the dock and its equipment and caused delay in its completion. We had hoped to have the ferry running early this summer, but we have had to postpone its opening till some date early in October next.

I am glad to tell you that the arrangements we have been able to make to secure freight from Spain, the South of France, Italy—when the clouds of war are spent—and Southern Central Europe are promising, and I hope that when the ferry comes into being it will add considerably to our traffic by reason of its convenience and rapidity of conveyance without breaking bulk.—*Mr. R. Holland-Martin at the Southern Railway meeting.*

Success of Electric Traction

The electrification of our line is proceeding satisfactorily, and according to plan. In July last we extended electric traction to Lewes, Seaford, Eastbourne and Hastings, and in October we re-opened the line between Elmers End and Sanderstead in the Croydon area and established electric services. At the same time we electrified the section of our line between Lewisham and Nunhead, and this enabled us to run a through service of trains from certain stations in the suburban area to St. Paul's. This was done with the object of easing the overcrowding that takes place during the rush hours on the trains into Cannon Street and Charing Cross.

You will be interested to hear the satisfactory financial result of some of our latest electrification schemes. When the estimates were prepared in 1932 for the electrification of the line to Sevenoaks via Orpington and via Swanley, it was estimated that an increase of 27·1 per cent. on the then revenue of the area would be sufficient to pay the increased cost of working, including the interest on the amount charged to capital. Last year was the first year operated under electric traction and the number of passengers increased by 55 per cent. and the revenue by 41 per cent., as compared with 1932.

On the Eastbourne and Hastings section of electrification it was estimated that an increase of 1·25 per cent. in the receipts would have met the cost of electrification. As a matter of fact the number of passengers increased in the first six months—*i.e.*, from July to December last—by 22 per cent. and the revenue by 16 per cent.—*Mr. R. Holland-Martin at the Southern Railway meeting.*

* Sir Robert Horne received a deputation at Paddington on this subject on March 16, as recorded on page 559.

Forthcoming L.N.E.R. Accelerations

We shall during the coming summer make further efforts to attract passenger traffic, and shall be able to make some substantial improvements in the running times of a number of our trains, and among others we have in view certain accelerations in some of our East Anglian services, and especially in that between Liverpool Street, King's Lynn, and Hunstanton. These proposed improvements are the outcome of the policy we have been constantly following in the strengthening of our permanent way and bridges, widening lines and increasing the power of our locomotives. —*Mr. William Whitelaw at the L.N.E.R. meeting.*

More First Class Journeys

You will be interested to know that the number of first-class passenger journeys increased by over 1,000,000, that is to say, from 15,089,000 in 1934 to 16,130,000 in 1935. Of this increase about one half was in journeys made by season ticket holders and the remainder in journeys by ordinary passengers. This is the second year since 1928 in which we have had an increase in our ordinary first-class traffic, and it is brought about partly by the generally returning prosperity of the country, but even more by the growing number of persons who, taking advantage of the new cheap ticket rates, gain the comfort of first-class travel by paying the 50 per cent. difference between first and third class that pertains to those cheap tickets.—*Mr. R. Holland-Martin at the Southern Railway meeting.*

Passenger Amenities on the L.M.S.R.

Those of you who travel regularly over the line have no doubt noticed the gradual change in the nature of our passenger accommodation, but it is the returning visitor from overseas who sees the railway at intervals who most notices the change which has taken place and is continuing. Much of it is made up of little things, such as additional catering services, separate kitchen cars, faster trains, better riding due in part to the track and in part to the coaches, the wide, low windows now used, the improved upholstery and springing of the seats, the arm rests and shoulder lights in long-distance third class coaches, the additional and improved lavatory accommodation, and the seat reservation arrangements. It is by these various means that the extra volume of passenger traffic was obtained and exceeded by some 2 per cent. that of 1929. In that I have regard to distance as well as numbers, and the total passenger miles, 7,837,000,000, is a striking achievement, representing 21,000,000 miles of passenger travel per day the whole year round, which, girdling the earth, would outdo a score of Shakespeare's Pucks.—*Sir Josiah Stamp at the L.M.S.R. meeting.*

Railway Rating and the Southern Railway

I will now return to the subject of rating with which I dealt very fully at our meeting last year. As we then anticipated, the Railway Assessment Authority and the local authorities appealed to the House of Lords against the decision of the court of the Railway and Canal Commission. It will be remembered that the Railway Assessment Authority had fixed our net annual value at £2,180,000 and that the Court reduced this to £1,077,131. The net annual value which has been in force since April, 1931, is about £1,840,000, so that the company's valuation was reduced by the court to the extent of about £750,000. The case came on for hearing in November last, and on January 24 the House of Lords gave its decision dismissing both appeals. The Court held that the Railway and Canal Commissioners had made their valuation on the right principle, but left it open to the appellants to apply to the Railway and Canal Commissioners to review their valuation of £1,077,131 in the light of their ruling on a number of subsidiary points. The appellants are in fact taking that course, so that the matter is to some extent still *sub judice*.

In the meantime we have given careful consideration to the position; we are advised that we may legitimately proceed to the assumption that our payments and contributions under the headings of "Rates" and "Railway Freight Rebates Fund" for 1935 have been on too high a basis; we have accordingly taken credit in the year's accounts for the sum of £250,000 under those headings. As I explained last year, under the provisions of the Local Government Act, 1929, 75 per cent. of our rate liability has to be paid into a fund called the "Railway Freight Rebates Fund" and the remaining 25 per cent. to the local authorities. The loss of rates suffered by the local authorities as a result of de-rating has been made good to them by grants from the National Exchequer. The 75 per cent. paid into the Freight Rebates Fund is distributed to traders in the shape of rebates on railway charges for certain selected classes of traffic. There is no question of recovering from the traders on account of the House of Lords judgment any of the sums allowed them as rebates, but any overpayments into the freight rebates fund during the past five years must in due course be repaid to us out of that fund.—*Mr. R. Holland-Martin at the Southern Railway meeting.*

L.M.S.R. Manufacturing Policy

Air services I will mention later, and our limestone quarry, a legacy from the old North Staffordshire Railway, no longer appears in the accounts, as this has now been leased by us on satisfactory terms. We have no desire to engage in any trading activities beyond our comprehensive service of transport, including its necessary adjuncts. I should add in this connection that I have recently had in two directions to restate our policy in regard to the complete or partial manufacture of our own requirements. Shortly, this policy is solely dictated by reasons of efficiency and economy, and while we have no desire to extend the conduct of our undertaking where supplies of requirements can be met by manufacturers at appropriate prices, we shall manufacture our own requirements where that is shown to be the more economical course in the long run. We purchase a large part of our manufactured or semi-manufactured requirements, and on the whole satisfactorily, but on more than one occasion lately we have had to countermand orders because of price difficulties. On the other hand, certain manufactures of our own have ceased where it was found that outside manufactures were cheaper and reasonable long-term assurances in regard to prices were obtainable.—*Sir Josiah Stamp at the L.M.S.R. meeting.*

Tourist Traffic in Ireland

The receipts from hotels and refreshment rooms amounted to £110,833, and showed an increase of £10,461, the trading profit being £9,369 compared with £7,891 for the previous year. The returns of tourist traffic for the year were very satisfactory. Both the Tourist Association and the transport companies were making special efforts to make the attractions which Ireland had to offer to visitors known all over the world. The agency which the Great Southern Railways had established in New York was doing good work, and the year into which they were entering they all hoped and believed would be a red letter one.

Under two heads they anticipated increased revenue in the current year: (1) The new trade arrangements concluded with Great Britain, which undoubtedly would lead to greater numbers of cattle being exported to England in the current year; and (2) the fact that much of the business which they last year acquired by purchase from competing concerns on the roads would only begin to affect the earnings this year, and the same applied to the 1936 acquisitions. —*Sir Walter Nugent at the Great Southern Railways meeting.*

More Diesel Railcars

Your directors are always seeking more economical means of conducting the company's business and, in pursuance of this policy, another diesel railcar unit was built during the year for suburban services. The results have so fully come up to our expectations that we now have two more under construction. In addition, the experiment of operating rail buses on sections of the line where the traffic is so sparse as not to warrant the running of steam trains has proved very successful.—*Mr. W. B. Carson at the Great Northern Railway (Ireland) meeting.*

"TELEGRAPHIC RAILWAYS"

Safety and economy on single lines as foreseen by a pioneer of telegraphy

THE association between railways and telegraphs is one of very long standing—dating back, in fact to the earliest days of telegraphic communication, and the present year is a suitable one in which to review the subject for it marks the centenary of one or two notable steps in the evolution of telegraphy. In 1836 Sir Charles Wheatstone (who became an F.R.S. in that year) was carrying out experiments on the transmission of signals over wires, and Sir William Fothergill Cooke (who became Wheatstone's partner in the following year) began to study electric telegraphy. Furthermore, Dr. Edward Davy wrote his "Outline of a New Plan for Telegraphic Communication," and in the same year William Sturgeon began publication of *The Annals of Electricity*—the first electrical journal to be produced in England. Cooke was thirty years of age in 1836, and was studying anatomy at Heidelberg, when he witnessed some experiments made with a primitive galvanometer telegraph by a Professor Möncke. He was so impressed with the possibilities of this application of electricity that he abandoned the idea of becoming an anatomical modeller and resolved to devote himself entirely to telegraphy. While yet in Germany he made some models of his own and, returning home, offered one to the directors of the Liverpool & Manchester Railway, but they considered it too complicated. Cooke was introduced to Wheatstone in February, 1837, and proposed that they should join forces and develop telegraphs together, to which, after some hesitation, Wheatstone agreed. They soon constructed their first multi-needle telegraph, which, on July 25, 1837, was tried on the Euston and Camden incline, then worked by rope haulage, but the apparatus does not seem to have appealed to the London & Birmingham Railway Company. In 1839 an installation was made on the Great Western Railway between Paddington and West Drayton. The cost was given at a meeting of shareholders on February 27, 1840, as about £250 a mile, but they "must not think it was in contemplation to continue the telegraph to Bristol." It was admitted to be a most valuable invention, cost alone standing in the way of its extension. This was due no doubt to the large number of line wires then required.

The first Public Telegraph

On May 16, 1843, the G.W.R. telegraph, substantially remodelled, was extended to Slough, and from April, 1844, it was announced that this telegraph was open to the public—the first service of its kind in this country. It created a great impression a few months later, when, on New Year's Day, 1845, a message sent to Paddington led to the apprehension of Tawell for the Salt Hill murder. In 1840 the inventors had applied another kind of telegraph on the London & Blackwall cable railway for communicating between the stations and the engine house. Its working was remarkably successful and induced Cooke to bring forward his views in his "Telegraphic Railways; the Single Way, &c.," a now little-known pamphlet that appeared in 1842. The publication was intended to show that single lines could be worked as safely as double, and that, in consequence, the cost of new lines could be greatly reduced where the traffic alone would not justify a double track. The fact that modern signalling apparatus has been used to increase greatly the carrying capacity of single lines in various parts of the world, and in some cases to enable double line to be converted to single, as in Ireland—a country Cooke had particularly in mind—without any reduction in the facilities afforded, makes the arguments used by him so long ago most interesting reading, for they show that he had a clear grasp of the essentials of the problem. "Two objects," he said, "are sought in the following pages. The first is to add to the safety and efficiency of railway communication by means not more, but less expensive than those now adopted. The second is, to overcome some objections to the formation of auxiliary single lines by suggestions calculated to give them the safety and efficiency now supposed to be exclusively within the reach of double lines."

Safety in Pre-Block Days

As there was no block system in use at that time, the separation of the two directions of traffic had been considered indispensable on almost all lines of consequence hitherto built, and punctuality and vigilance, if observed, conferred on them as much safety as could possibly be expected. In any case, to use the words of a Board of Trade Committee of 1841, "the inherent danger of railway travelling" was "very small," and "even under the present system less than that of other modes of conveyance." But the committee went on to say, "It is not, however, in reference to comparative but to absolute safety that the question must be considered. The public have a right to expect that the maximum degree of safety which the nature of the case admits, should be attained without reference to the safety of other modes of travelling. This is the more necessary as railway accidents, when they do occur, are frequently of a frightful character and calculated to cause a panic in the public mind." These remarks suggest that the modern attitude of paying disproportionate attention to railway as against road mishaps is at bottom no new phenomenon. Cooke pointed out that the chance of accidents would be reduced to a minimum if punctuality and vigilance were "aided by a power of at any time surveying, as at a glance, the state and condition of all the trains on the road, at numerous given points." Railways have had to wait a long time for a complete realisation of this thought in centralised traffic control, but the words quoted show that Cooke was not aiming at merely signalling from station to station, as in a block system—although the Great Western used his telegraph in that way at first—but at showing the condition of the whole railway constantly at certain principal points. Actually, as in the installation made in 1844 on the Norwich & Yarmouth Railway, he endeavoured to do this at every station so that all were aware of the position throughout the line, or at least their division of it. In his own words "The comparatively high degree of safety now attained in railway travelling depends, as I have said, upon vigilance and punctuality in the conduct of trains; it is proposed to superadd a physical certainty of their relative places on the line at any moment."

The difference between road and rail transport, said Cooke, was—as it still is—that one was flexible, owing to the absence of a fixed path, and the other was not, while on the railway much longer distances were necessary in which to pull up. These disadvantages could be largely countered by providing drivers with a "bird's-eye view" of the line. In possession of that they "might proceed fearlessly, whether in time or out of time, on the right

or the wrong line, as their speed could always be slackened soon enough to avoid collision.'' In this sentence reversible working is clearly proposed and Cooke's prophecy has been realised in several modern signalling installations, especially in the United States. Under the time-interval system prevailing in 1842, perfect punctuality would provide this bird's-eye view because the position of other trains would be known as '' a certain inference,'' but the electric telegraph, Cooke said, would enable it to be known as '' a certain fact,'' whether the trains were punctual or not. It was already being generally admitted that anything like perfect punctuality was utterly unattainable. The Liverpool & Manchester Railway had abandoned even the principle of punctuality and the Secretary, Mr. Booth, said there was nothing for it but to trust to the vigilance of drivers; the time interval being a light which was '' always uncertain and often deceitful '' it was '' better to be on the alert in the dark.''

Economy of Single Lines

Cooke's principal object was, as we have said, to advocate a greater use of single lines on the score of economy. The subject had just been attracting some attention in connection with the proposed Canterbury to Ramsgate line, which, it was suggested, should be made single. *The Railway Times* of January 23, 1841, had had a leading article on the general question and had also warmly supported the construction of a single line between the towns named. It complained that this plan ought to have been followed in many other cases. As it had not, railway costs had been out of all proportion to the earnings to be anticipated. A '' ruinous policy '' had been followed and secondary lines constructed '' on a scale of magnificence vying with the great channels of communication throughout the kingdom.'' Incidentally, the same paper had some hard words to say about engineers' estimates, which were constantly found inaccurate when a line came to be made, and suggested that their fees be reduced in proportion to their errors, as an effective way of making them careful!

Cooke therefore outlined a scheme for working the Midland Counties Railway as a single line, in three divisions, namely: Derby to Loughborough, 17 miles; Loughborough to Leicester, 13 miles; and Leicester to Rugby, 20 miles; divided into 4, 3, and 5 sections respectively. At each station on a division there was to be an instrument of the Cooke and Wheatstone needle type with electrical alarum, having a dial for each station, there being therefore five dials on the instruments on the Derby-Loughborough division. At the intermediate divisional points, Loughborough and Leicester, there were of course two complete instruments. Each dial could indicate permanently either an up train, a down train or no train by means of the needle, which could also be used for conversing. In this way Cooke proposed to indicate the progress of a train from station to station. The departure of a train from a divisional point would thus be known at once at the next such point, enabling traffic arrangements to be made accordingly.

The scheme would not, however, have given the security its inventor imagined. It provided no checks on mistakes or carelessness, and the working was not so simple as Cooke seems to have thought. Experience soon showed that a simple telegraph was a dangerous arrangement for working single lines, which had to wait several years before the invention of electric token apparatus by Tyer gave them safety and flexibility combined in an exceptional degree. Nevertheless Cooke had a clear understanding of the traffic problem involved, as several pages of his pamphlet show. He suggested the use of spring switches at passing loops '' infallibly directing the trains to the proper side '' and over-run sidings with buffers to prevent the station being passed without permission. He also proposed that fixed signals should be normally at danger, considering it '' essential on a single way that a train should not proceed without a particular affirmative order. I think it highly desirable that the ordinary, or quiescent, condition of the station signal should be a state of danger, not a state of safety, so that a train should never run into a station without a special guarantee that it was prepared to receive it.''

Cooke concluded his arguments by saying that he was not opposed to a double line where traffic necessitated it, but that he protested against '' the ruinous policy of making country lanes as wide as metropolitan thoroughfares.'' He perceived very well the great expense which accidents occasioned, the absurdity of accepting them as unavoidable, and spending money on '' lamps and buffers '' which '' may be valuable in their places to prevent accidents when the signals are seen and to soften collisions when they are not seen,'' while ignoring the primary cause of the danger—the uncertainty as to the position of the trains.

Although single lines were soon built all over the world by men who knew nothing of his ideas, nevertheless almost all his basic proposals have now been adopted with the aid of apparatus of which he could have no adequate conception. There is today no engineering difficulty in making a single line railway perfectly safe and providing, at one or more points as desired, that bird's-eye view which Cooke thought so essential to efficiency nearly one hundred years ago.

G.W.R. Docks in South Wales

IN our issue of March 6* reference was made to the serious concern which had been manifested throughout South Wales as the result of the remarks made by Sir Robert Horne at the recent annual meeting of the Great Western Railway when, after referring to the almost negligible return now being earned by the company from its vast expenditure on dock undertakings, he intimated that unless there was a substantial increase in trade in the near future, or a higher scale of dock charges, the company would have no alternative but to seek the sanction of Parliament to the concentration of the traffic at fewer ports.

We now learn that on March 16, Sir Robert Horne received at Paddington a deputation from the National Industrial Development Council of Wales and Monmouthshire, who represented that considerable anxiety had been occasioned in South Wales by his remarks. A very full discussion ensued during which Sir Robert intimated that the whole question was receiving very careful consideration owing to the extremely serious decline in business which had been experienced at the South Wales Docks, but that no immediate steps were likely to be taken in the direction of closing any of the existing facilities. He stressed, however, the necessity for obtaining an increase in the tonnage dealt with and stated that the company would welcome the active co-operation of the Industrial Council with the object of improving trade in South Wales and Monmouthshire. It is understood that the council proposes to call an early meeting for the purpose of considering the best means of endeavouring to achieve this end.

* See also page 556 of this issue.

THE STORSTRØM BRIDGE

Some constructional details of this great new Danish railway bridge

THIS bridge, as projected, was briefly described in THE RAILWAY GAZETTE of April 28, 1933, and some additional information about it was also published in the issue of May 19 of that year. It is now possible to give a further account of progress. The main contractor for the bridge is Dorman Long & Co. Ltd., with Christiani & Nielsen as sub-contractors for the foundations, piers, and other concrete work.

The piers are of mass concrete, the upper parts of them hollow. But from 2·5 m. below to 2·5 m. above mean sea level they are solid and heavily encased in granite ashlar to ward off pack-ice, collision or storm damage. Still further below water they widen out into large oval bases, and are founded upon clay in from 20 to 50 ft. of water.

For the construction of 41 of the piers the following method is being used: Three different so-called " units " have been constructed, by means of which a similar number of types of pier can be built. The " unit " is a special steel caisson, internally the size and shape of the oval base plate of the pier. The lower part of each unit is divided by vertical bulkheads into several isolated compartments, and its lower edge is reinforced to serve as a stiffening ring. The " unit " is fitted with motor pile-driving gear for driving cofferdam sheet piling for excavation, and with pumps for raising and sinking the " unit."

Before proceeding to a pier site, each " unit " has a skirt of sheet piling suspended around it, and it is then towed to the site of the pier and lowered by filling the various compartments between the bulkheads with water. The site of the pier is levelled to an even surface beforehand by means of a dredger. The sheet piling skirt is then lowered and driven by stages with Terry hammers down to a maximum of 40 ft. into the clay. The top of the ring of sheet piling when driven bears against the caisson walls, and timber blocks are forced into the hollows in the piling and between it and wooden strips on the caisson, so as to form a watertight joint or packing. The sheeting and caisson then together form a cofferdam, from which the water can be pumped and within which the sea-bed can be excavated and replaced by concrete. The external water pressure will automatically press the sheet piling tightly against the packing.

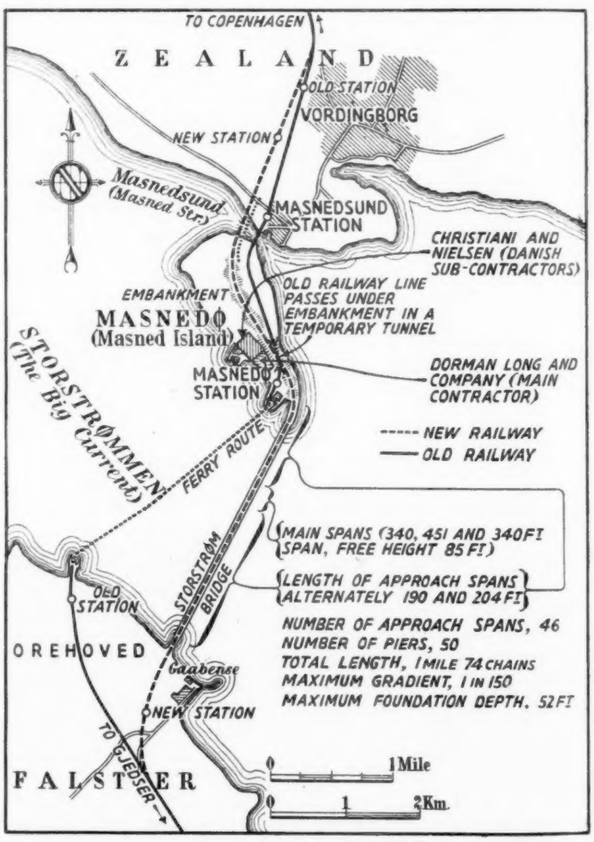
The inner sides of the caisson walls taper inwards towards the top, and this and the fact that they are given a special surface treatment to prevent the concrete sticking to them, enables each caisson unit to be floated clear when the level of the concrete is 10 ft. only below mean sea level. A concrete pier foundation slab and shaft, both oval in plan, but the former having vertical walls and the latter conical, is thus left *in situ*.

For the piers in deep water the granite facing is built up and backed by concrete to a little above sea level, before the caisson unit is removed. For the piers in comparatively shallow water a cofferdam is constructed, consisting of two symmetrical parts, each of which is floated into position, where they are connected, and the water inside is pumped out; the facing is then built up and the concreting done. The pier superstructures are built up in the usual way.

The construction of the foundations of the four piers for the large navigation spans is carried out to full height inside a cofferdam of sheet piling which is driven in the usual way from a platform, and a pair of steel bracings is used as stiffening frames. The piers are elliptical in plan, 14 m. × 29 m. (46 ft. × 95 ft.). When the water has been pumped out and a stiffening frame of reinforced concrete—made of rapid hardening cement—has been inserted, the excavation of the bottom is carried out and the foundation slab cast against the sheet wall. For the upper part of the pier ordinary centring is used. The level of the bottom of the pier foundations is about 12 m. (40 ft.) below m.s.l., and the sea bed level is here about 9 m. (30 ft.) below m.s.l. In this case no excavation is carried out on the site in advance.

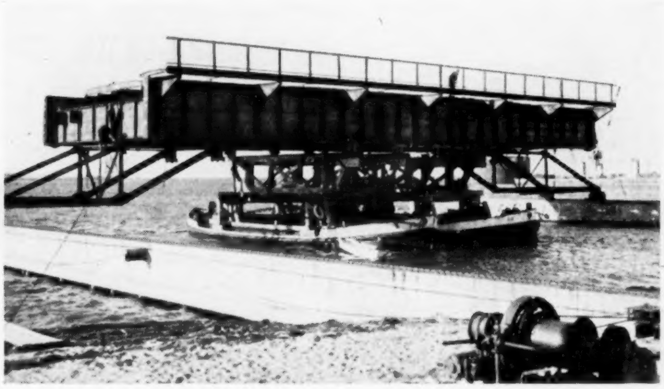
The four piers on the Masnedö (or north) side, which are in very shallow water, are constructed in practically the same way, a ring of sheet piling to full height being used, braced with ordinary timbering. After excavation the concreting is done. When the part of the pier with granite facing has been carried up above water level, the dam can be filled with water and the sheet piling cut off 0·5 m., say 18 in. above the top of the foundation, and removed. Then the top part of the pier is constructed in the usual way.

The superstructure for the 47 approach spans is in the form of steel plate girders, each 12 ft. deep. The spans are of the cantilever type, the anchor arms being 57·8 m.



Sketch map showing position of new bridge and its approaches, contractors' yards and ferry

Caisson "unit" with skirt of sheet piling ready to be towed to site



Central suspended portion of approach span ready for floating out to its final position between cantilever type spans

(190 ft.), the cantilever arms 8·89 m. (29 ft.) and the suspended spans 44·45 m. (146 ft.) in length. The superstructure for the three navigation spans is also of

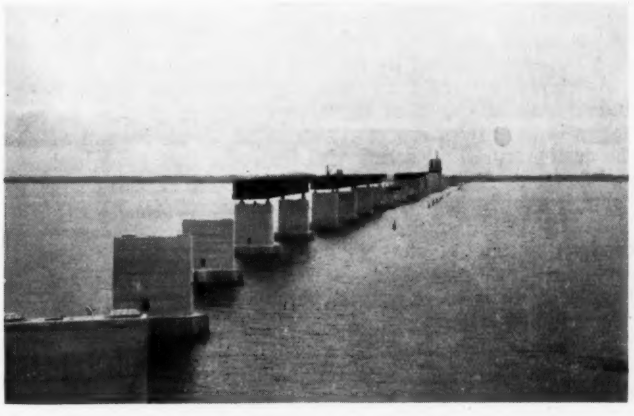
Half plate-girder portion of navigation span, supported on temporary pier prior to addition of second half and of steel arch reinforcement

steel plate girders, 12 ft. deep, reinforced with a steel arch rib over each span. The longest girder and steelwork sections, which are being sent out from England by Dorman Long & Co. Ltd., are 40 ft., and assembling and erection is being done at Masnedö. The completed spans, weighing up to 460 tons, are then lifted bodily by what is believed to be the largest floating crane in the world, and placed on the piers. This crane is capable of lifting 500-ton loads to a height of nearly 100 ft. and is mounted on two pontoons, each 165 ft. × 27 ft. The three main spans are too large for this method of erection, and are therefore lifted in halves, and the two halves are supported in the centre of the permanent span by a temporary pier, the stiffening arch being subsequently erected, the span riveted up as a whole, and the temporary pier removed. The superstructure of this temporary pier is built up as a unit, and is used in turn for each of the three main spans.

The work as a whole is now well advanced, the bulk of the superstructural work—including both pier building and girder erection—having now been completed. The erection of the 450-ft. and 340-ft. navigation spans is proving a particularly interesting job as a result of their unusual arch-stiffened plate girder design.

In conjunction with the main bridge, a combined road and rail bridge across the small Masnedsund channel, about two miles from the Storstrom, has been built to replace the old railway bridge. This new bridge, which has now been completed, is a low-level structure with a bascule span giving a free passage opening of 25 m. (82 ft.) The total length is about 200 m. (660 ft.).

Cantilever type approach span being lowered on to piers by 500-ton floating crane



General view of bridge with some girders in position on piers. Note steel arch reinforcement of navigation span in distance

DUPLEX BOGIES

These bogies have free wheels on independent axles. Super-Duplex bogies in extensive regular service have been giving smooth running and cheap upkeep

WITH the ever-increasing speeds demanded of railways, wind resistance is not the only factor which has to be reckoned with, and the natural tendency is to look for reduction of all forms of resistance, especially in the hauled vehicles. Here, though satisfactory up to a point, the standard type of bogie may be improved both in detail and in general principles of construction, as is proved by the performance of the Super-Duplex* type of bogie, which for some time past has been running experimentally on the Swiss Federal Railways. This bogie was built by the Swiss Locomotive and Machine Works, Winterthur, for the Swiss Federal Railways, in accordance with designs evolved by Mr. J. Buchli. The coach AB4ii2680 (Fig. 1), was placed in service in December, 1934, on through trains Nos. 8 and 25 between Geneva and St. Gall, and has now been running continuously for about 15 months, apart from undergoing trials for some weeks on the P.L.M. Railway of France. This vehicle has seating accommodation for 12 first class and 30 second class passengers, and its tare weight is 44,000 kg. (43¼ tons).

The new construction has been the object of unusually prolonged inspection by representatives of railways in other countries. Further reference is made later to the comparative tests under the auspices of the French O.C.E.M., and we understand that at the express wish of the Belgian railways, the coach was run on the Berne-Ostend service for some time last summer. Belgian and Dutch engineers availed themselves of the opportunity of seeing and riding in the coach. The novelty of the construction, its performance in service, and the widespread interest evinced by Continental engineers entitle the new bogie to careful consideration.

Constructional Features

The new types of bogie are designed not merely to reduce journal friction to a minimum by the use of roller bearings, but also to eliminate the much greater frictional resistance and waste of power resulting from the rigid attachment of a pair of wheels to a common axle. Furthermore, they permit reduction of the rigid wheelbase and avoid the statically indeterminate conditions of loading arising from four-point support on the rails. Finally, the usual method of supporting the coach body on a central swivel plate, an arrangement very favourable to swaying, is eliminated by the new constructions.

As shown by the accompanying illustrations (Figs. 1 and 2) one of the most distinctive features of the new bogies is the use of separately mounted wheels instead of the customary wheel sets. Also, in order that the wheel and flange loadings may be as small as possible, each bogie comprises eight wheels of 750-850 mm. (2 ft. 5½ in.-2 ft. 9½ in.) diameter.† The wheels are single-piece castings of special steel (Fischer, Schaffhouse) without separate tyres, and their small diameter is made practicable by their number being doubled. Pairs of wheels are mounted in tandem in H-frames, as in Figs. 3 and 4, with short axles carried by S.K.F. roller bearings. The main frames of the bogie rest on heavy helical springs in the H-beams, and are dropped at the centre to accommodate the pivot pin construction, the cross beam connecting the side frames, and the main body springs. Displacement of the cross beam in the direction of coach travel is prevented by U-shaped frames or stirrups attached to the undercarriage of the body and fitted with slides as shown in the general view of the vehicle (Fig. 1). The cross beam is thus capable of only vertical and limited sideways movements and it serves the purpose of a swinging bolster, the carrying springs restoring the coach body to the central position, as further explained later.

The H-frames of opposite pairs of wheels are connected by ball-jointed tie rods attached to the lower part of the inside bearing shells, as shown in Fig. 2. These rods maintain the correct track gauge of the bogie. As each H-beam can turn in a horizontal plane about a point between its wheels, each pair of opposite H-beams forms a subsidiary bogie, which is itself capable of following track inequalities. On curves, all four wheels on one side of the Super-Duplex bogie bear on the outer rail. The springs between the H-beams and the main frames restore the subsidiary bogie to its central position after displacement.

Another characteristic feature of the construction is that each of the two dropped main frames, independently of the other, is free to turn both horizontally and vertically about a point at the centre of the dropped part of the frame. The swivel construction is in an oil-filled casing and provides also for the support of the coach body. The wheels at each side of the vehicle are inclined inwards at the slope of the rails (1 in 20), as shown in Fig. 2, thus making it possible to use tyres with cylindrical treads. In the Duplex four-wheel bogie the arrangement is substantially as in Fig. 2 except that no H-type underframes are required with single instead of tandem pairs of wheels. The method of driving the lighting dynamo, by Brown Boveri & Cie, Baden, is shown clearly in Fig. 5.

Elimination of Slip and Reduction of Wear

In an ordinary bogie, slipping occurs at one or both wheels of a wheel set if the wheels are of unequal diameter or running on curved track; also, the oscillating torque round the pivot pin, resulting from the conical wheels riding up and down the rails, causes side swaying which is more serious the greater the clearance between the wheel rims and track. With worn rims, the slip due to the wheels running on different diameters of tread may be $4\,\pi = 12{\cdot}56$ mm. (½ in.) per revolution on straight track and more on curves with increased track gauge. With new rims, the maximum slip on straight track is 4 mm. (5/32 in.). The average slip due to the cause considered is thus $\frac{1}{2}\,(12{\cdot}56 + 4) = 8{\cdot}28$ mm. (about 5/16 in.) per revolution. This slip is avoided by the singly-mounted wheels of the Duplex or Super-Duplex bogie, thus reducing wear and permitting the use of higher brake block pressures without risk of locking the wheels.

The wheelbase of standard bogies ranges from 2·5 to 3 m. (8 ft. 2½ in. to 9 ft. 10 in.), rising to 3·6 m. (11 ft. 10 in.) or more in some recent designs. The guiding properties of the bogie improve with the increase in wheel base but so, too, does the angle of incidence of the rim

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* The basic principles of the Duplex and Super-Duplex bogies are the same, the term Duplex being applied to the four-wheel construction mentioned later, and Super-Duplex being the name of the eight-wheel construction shown in the photographic illustrations.

† As mentioned later, the essential features of the construction can be applied to a four-wheel bogie if desired.

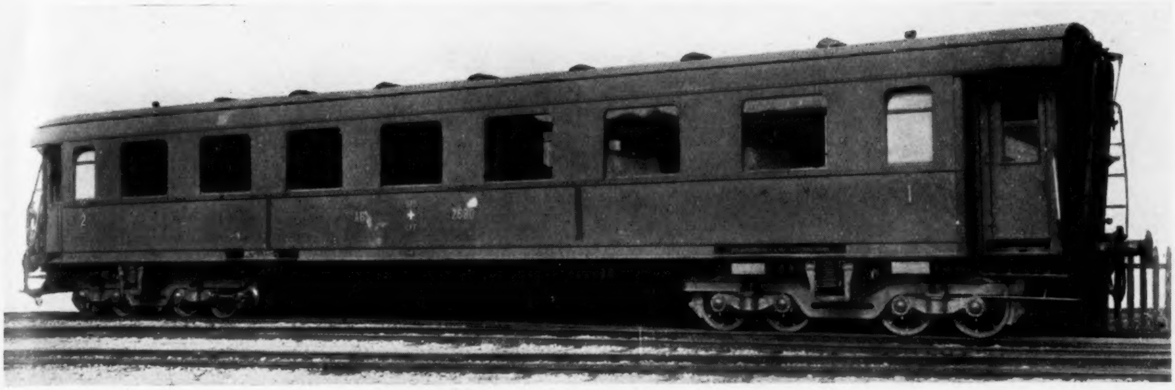
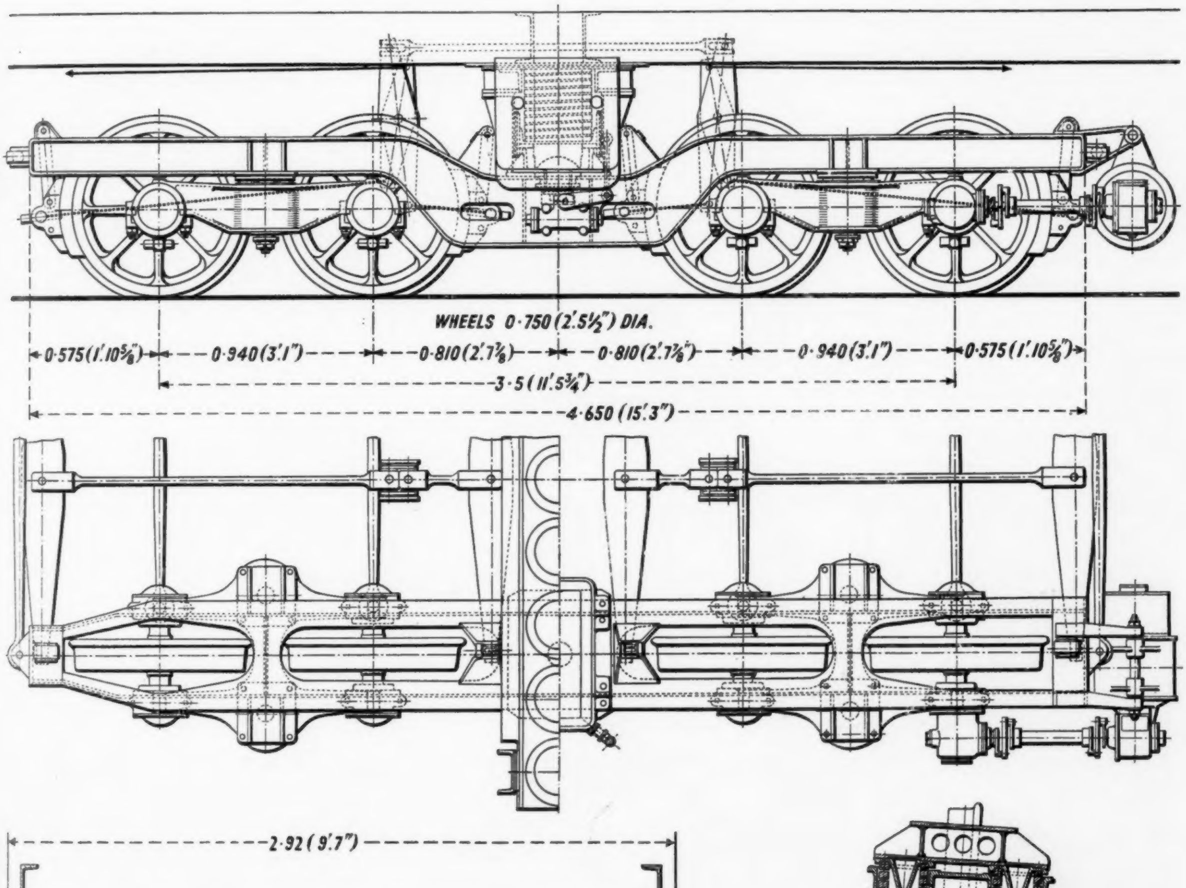
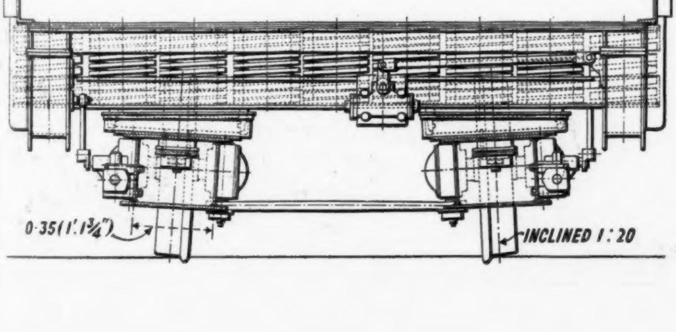


Fig. 1—Swiss Federal Railways coach fitted with Super-Duplex bogies, which have been in regular service for about 15 months and have been subjected to special trials by the O.C.E.M. on the P.L.M. Railway of France and elsewhere





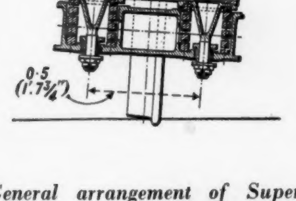


Fig. 2—General arrangement of Super-Duplex bogie built by the Swiss Locomotive and Machine Works, Winterthur, for the Swiss Federal Railways

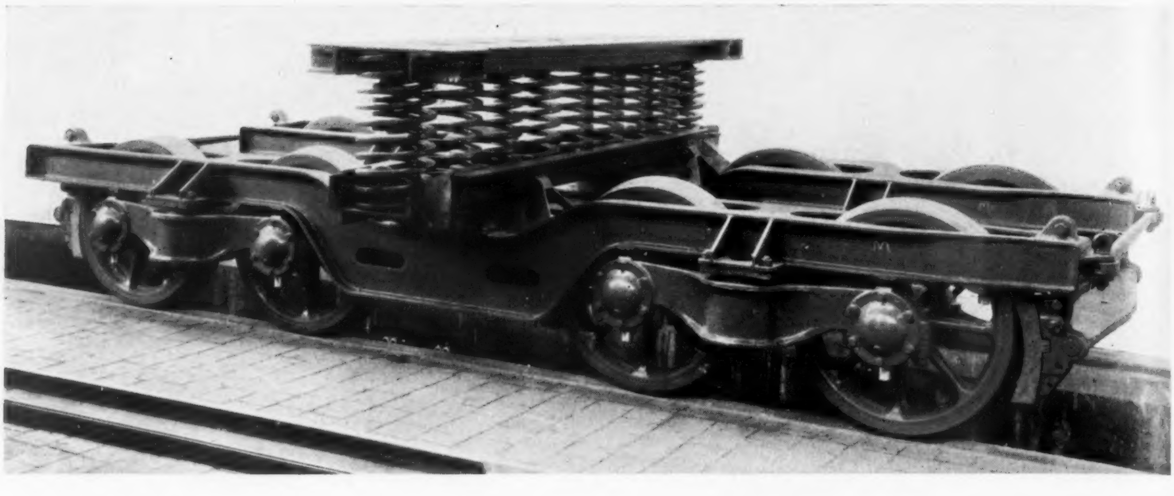
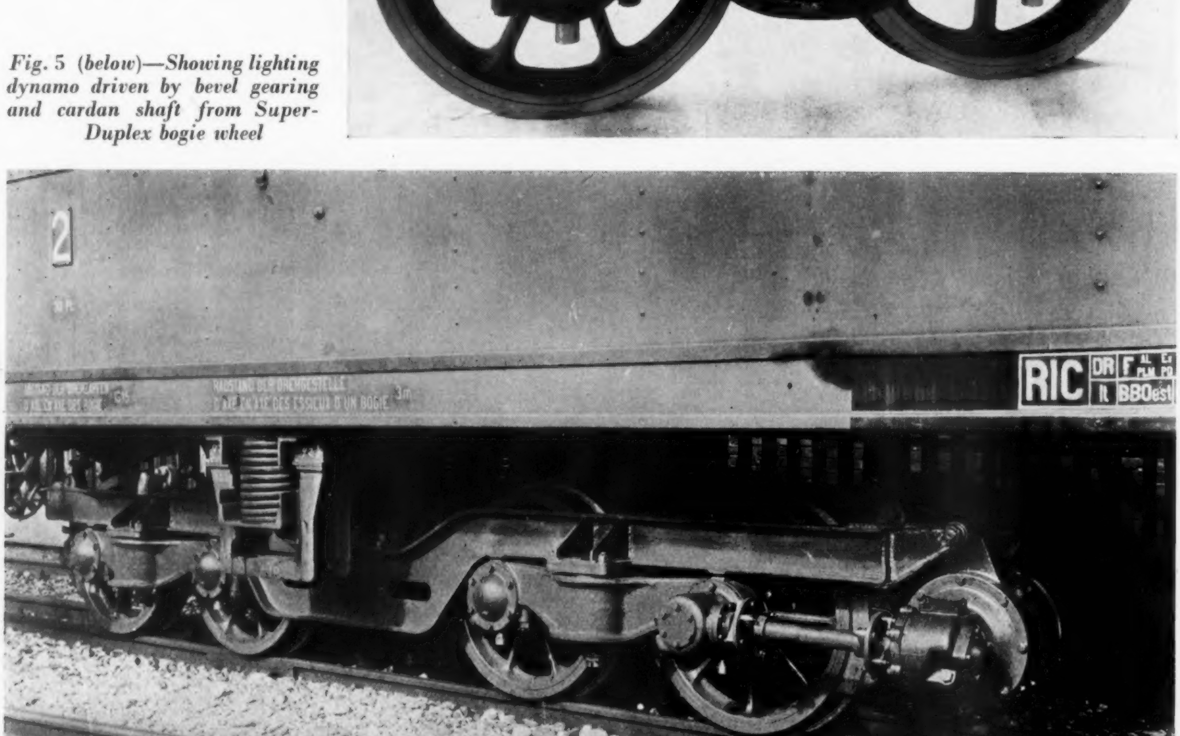


Fig. 3 (above)—Showing tandem arrangement of wheels (no axle connection between opposite wheels), frames, and main carrying springs of Super-Duplex bogie

Fig. 4 (right)—Tandem pair of Super-Duplex bogie wheels, showing H-frame with springs for carrying main frame

Fig. 5 (below)—Showing lighting dynamo driven by bevel gearing and cardan shaft from Super-Duplex bogie wheel



on curves, resulting in rapid wear. Fig. 6 shows diagrammatically the positions on a curve of a Super-Duplex bogie and a standard four-wheel bogie of the same total wheelbase. The angles of incidence of the first wheel in each case are given in Table I; the angle for the Duplex bogie being about one-quarter of that for the standard bogie of equal wheelbase.

The tractive resistance of the Super-Duplex bogie is lower than that of ordinary bogies, particularly on curves, and the independent mounting of the wheels prevents corrugation by eliminating frictional oscillations. The absence of axlebox guides and the use of roller bearings limit the side play of the bogie to the amount permitted by wear of rails and wheels. The rate of wear on the rims is reduced by the lower wheel loading.

Springing and Riding Characteristics

The general arrangement of the Super-Duplex bogie provides ample space for the exclusive use of helical springs, thus eliminating the frictional resistance of plate springs, which transmits wheel vibration set up by track irregularities to the body of the vehicle. On the other hand, frictionless springing favours resonant oscillations, to avoid which liquid dampers are fitted as shown in Fig. 2. The damping effect of friction in plate springs is substantially constant, but that of liquid dampers varies from zero to a maximum according to a variable curve, adjustable as required.

With the usual method of body support at the centre of the bogie frame, a track irregularity of height (*or* depth) *s* lifts (or lowers) the wheel by an amount *s*, the bogie swivel plate $\frac{1}{2}$ *s* and the centre of the coach $\frac{1}{4}$ *s* (Fig. 7). In the Super-Duplex bogie, however, the displacement of the bogie centre is $\frac{1}{4}$ *s*, and that of the centre of coach body $\frac{1}{8}$ *s*, or half the amount for ordinary bogies. Moreover, the wheel loading being halved in an eight-wheel Super-Duplex bogie, compared with an ordinary four-wheel bogie, the rail depression at joints is correspondingly decreased and there is a further improvement in the smoothness of riding. The reduction of body movement for given track irregularity applies equally to vertical and horizontal (transverse) movements, as shown by Fig. 7,

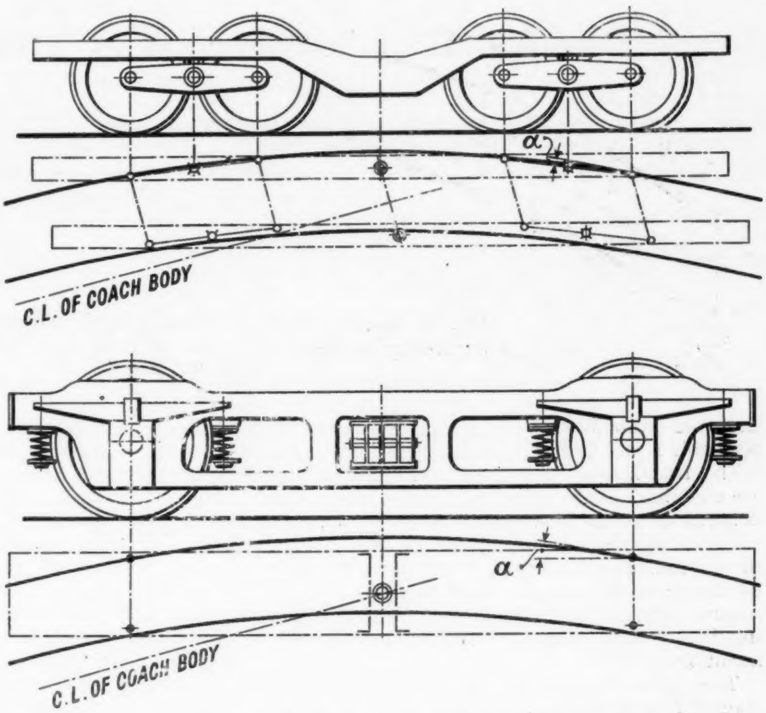


Fig. 6—Comparing positions on curve of Super-Duplex and standard bogies of equal wheelbase

TABLE I.—ANGLES OF INCIDENCE OF THE FIRST WHEEL IN SUPER-DUPLEX AND STANDARD BOGIES OF EQUAL WHEELBASE

On curve of radius.. ..	290 m. (919 ft.)	114 m. (374 ft.)
Duplex bogie	α = 5′ 9·5″	α = 12′ 39″
Standard 4-wheel bogie :		
With flanges of both outer wheels in contact with outer rail..	20′ 15″	49′ 45″
With flanges of outer leading wheel and inner trailing wheel in contact with the rails	41′ 5″	1° 21′

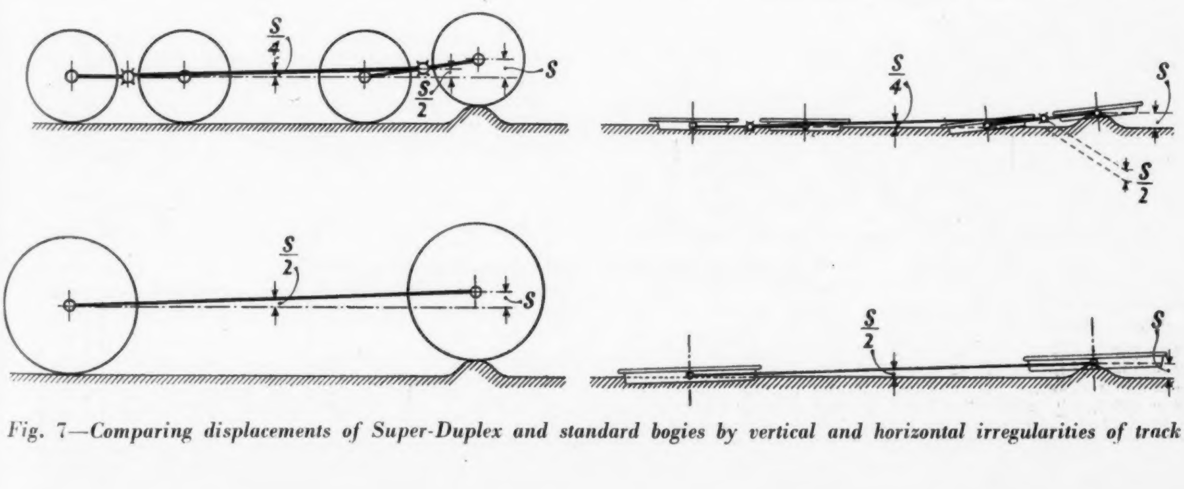


Fig. 7—Comparing displacements of Super-Duplex and standard bogies by vertical and horizontal irregularities of track

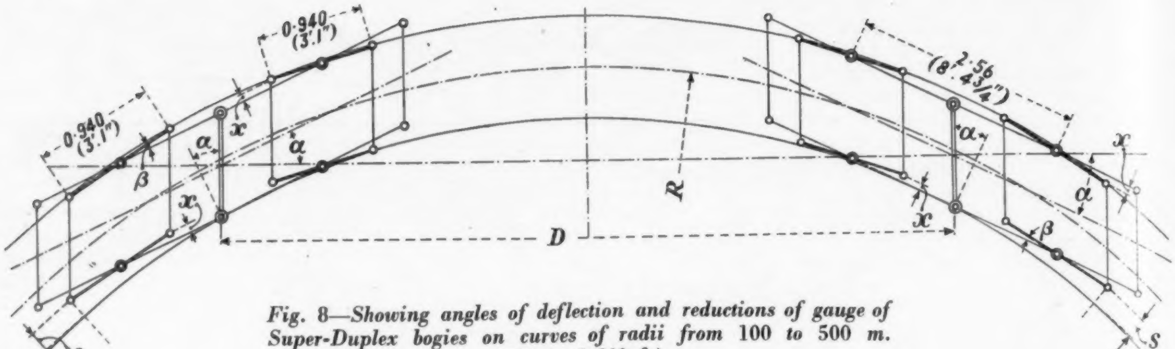


Fig. 8—Showing angles of deflection and reductions of gauge of Super-Duplex bogies on curves of radii from 100 to 500 m. (328 to 1,640 ft.)

and the smoothness of riding is increased by the regulable liquid damping of the main body springs.

The functions of swinging bolster and body springing are combined in the new bogie. The nine helical springs between the cross beams shown in Fig. 3 tend automatically to restore the coach body to the central position, the centralising or restoring force for a given lateral displacement being greater the heavier the loading of the coach. This action is obtained without any parts involving friction and wear, or requiring lubrication or other attention.

The wheel loading of the new bogie remains constant for every position of the wheels, resulting in statically determinate conditions and increased security against derailment. The position of the bogie on curves is shown by Fig. 8. The main frames of the bogie are coupled by cross rods at the ends, the combination always forming a parallelogram and resulting in a reduction of gauge s, values of which are given in Table II, together with the corresponding values of the deflections α and β and displacements x for different distances between bogie centres and various radii of curves.

Comparative Trials

Trials were carried out during May, 1935, by the French Office Central d'Etudes de Matériel de Chemins de fer (O.C.E.M.), in collaboration with the P.L.M. Railway, in order to compare the performance of the Swiss Super-Duplex bogie coach with that of various steel coaches belonging to French railways and mounted on Pennsylvania bogies.

TABLE II.—ANGLES OF DEFLECTION AND REDUCTIONS OF GAUGE OF DUPLEX BOGIES ON CURVES OF RADII FROM 100 TO 500 M. (328 TO 1,640 FT.). SEE FIG. 8

Deflection β ..	44 ft.	29 ft.	22 ft.	15 ft.	9 ft.
Displacement x mm. ..	6	4	3	2	1·2
(in.) ..	(0·236)	(0·157)	(0·118)	(0·079)	(0·047)
Radius of curve R, m. ..	100	150	200	300	500
(ft.) ..	(328)	(492)	(656)	(984)	(1,640)

For these trials, a train was made up consisting of the Swiss coach with Super-Duplex bogies, and five main line corridor bogie coaches, one from each of the principal French railway systems. The Eastern Railways coach was new, having just been built, and the other four French coaches had been overhauled just before the trials, so that all five should have been in the best possible running order.

In order that none of these coaches should be directly influenced by the movements of the locomotive or rear van, the train of coaches under investigation was preceded and followed respectively by a coach and a van.

Each coach was provided with two Hallade recorders, one in a central compartment and the other in a compartment above a bogie pivot. An additional Hallade recorder placed successively near each of the others established a common basis of comparison. Finally, records were taken, in each coach in turn, with a Mauzin-Beaudouin accelerometer* utilising the piezo-electric properties of quartz, and with a Huguenard mercury-column accelerometer as utilised by the Eastern Railway.

The trials were made during the journey from Dijon to Avignon on May, 9, 1935, and the return journey on May 10, this route being chosen in order to permit running at the maximum speed of 120 km. (74·6 miles) an hour for a sufficiently long period on track not in a specially favourable state of maintenance.

The trials showed that the Swiss coach with "Super-Duplex" bogies had appreciably greater stability than the other coaches, not only on straight track but also and especially when entering curves. Analysis of the recorder diagrams showed that the vertical and transverse oscillations were smaller in the coach with the Super-Duplex bogies. On the other hand, the running of this vehicle was definitely more noisy. We are informed, however, that the noise is not associated with the special features of the new bogie and that it can be eliminated in future constructions.

Though the rims of the wheels, after running for about 200,000 km. (124,000 miles), have not yet been turned, the coach, unlike others with standard bogies, shows no tendency to sway even at high speeds.

* Described in *Revue Générale d'Electricité*, April 20, 1935.

Angle of deflection α and Reduction of Gauge s, mm. (in.)

Distance between bogie centres	α	s	α	s	α	s	α	s	α	s
8 m. (26 ft. 2 15/16 in.)	2° 17′	2·5 (0·098)	1° 31′	1·05 (0·041)	1° 8′	0·60 (0·024)	0° 46′	0·3 (0·012)	0° 28′	0·1 (0·004)
10 m. (32 ft. 9 11/16 in.)	2° 52′	3·35 (0·132)	1° 55′	1·56 (0·061)	1° 26′	0·82 (0·032)	0° 58′	0·4 (0·016)	0° 35′	0·15 (0·006)
14 m. (45 ft. 11 3/16 in.)	4° 1′	5·7 (0·224)	2° 40′	2·55 (0·100)	2° 0′	1·5 (0·059)	1° 20′	0·6 (0·024)	0° 48′	0·3 (0·012)
18 m. (59 ft. 0 11/16 in.)	5° 10′	8·7 (0·343)	3° 26′	3·75 (0·148)	2° 35′	2·18 (0·086)	1° 43′	0·97 (0·038)	1° 2′	0·35 (0·014)

STAINLESS STEEL IN LOCOMOTIVE ENGINEERING

IT was not until after the war that stainless steel became generally available to industry, and then railway engineers were quick to realise its advantages. There are many varieties of these steels, and their development has proceeded rapidly, largely owing to the increasingly close co-operation between engineers and steel makers of recent years.

Stainless steels may be classified in two groups, the martensitic, which is suitable for hardening, and the austenitic, which cannot be hardened. The typical member of the martensitic family is the 13 per cent. chromium, 0·30 per cent. carbon steel, of which analysis the other steels in the class are modifications, either by lowering the carbon content (giving stainless iron) or by increasing the chromium and adding nickel up to 2 per cent., which gives the type of steel covered by B.S. Specification S.80. Austenitic stainless steels are all modifications of the well-known 18/8 steel sold under various trade names in this country and abroad, containing about 18 per cent. chromium and 8 per cent. nickel.

Martensitic Stainless Steels

Martensitic steels present a useful range of mechanical properties. They can all be hardened from a temperature in the neighbourhood of 950° C., and tempered, giving a choice of steels with maximum stress ranging from 35 to 120 tons per sq. in. For locomotive work they are used chiefly for the valves or seatings of boiler fittings, such as safety valves, injectors, stop valves, whistle valves, blow-off cocks, and other parts that are subject to erosion. The advantage of stainless steel for valve parts, particularly internal valves and seats, is its resistance to erosion coupled with its rustless properties—a valve made of softer materials will lose efficiency from damage of the working faces by a particle of entrapped solid foreign matter. This may cause slight leakage, and the rapid passage of high pressure steam quickly erodes the material in its path; consequently the valve has to be taken out of service or has to be re-ground after a comparatively short life.

Stainless steel may be hardened so that it is not likely to suffer damage in the first place, and if bruising does occur, the escaping steam will not enlarge the leak by erosion. If any doubt exists as to the value of stainless steel for valves, it is interesting to replace the valve and seat in a steam whistle valve with stainless steel and to note the result. Whistle valves in softer metals quickly display a feather of escaping steam, but a correctly ground and fitted stainless valve will give a continuous steam-tight joint. A note on the machining of stainless steels is given later, but it may be taken that the martensitic (hardenable) steels do not present any exceptional difficulties. The coefficient of expansion does not vary greatly from that of mild steel or cast iron, so that stainless seats may be pressed into mild steel or cast iron bodies. With bronze or gunmetal bodies it is advisable that stainless seats should be screwed in.

It should be noted that there is a tendency for stainless steel to seize when in sliding contact with another member of the same material; therefore for steam cocks it is desirable that a stainless plug should be used with a mounting having a non-ferrous metal body; proper consideration must be given to these facts when specifying stainless steels. It is well known that a combination of two different metals, one ferrous and the other non-ferrous, causes electrolytic action under certain conditions, and it has been found that the lower chromium stainless steels are liable to attack in this way. This difficulty has been overcome by increasing the chromium content to 17-18 per cent. Stainless steels of this analysis have rather low ductility, but the mechanical properties may be restored by the addition of 2 per cent. nickel. Steel of this type is covered by specification B.S.I. S.80.

For valve spindles, pump rods, or any detail working through non-ferrous metal bushes or graphited asbestos packing, it is advisable to use a steel of the above composition to avoid attack from galvanic action. Stainless steel has been used successfully for many auxiliary details of locomotive work, such as vacuum brake piston rods, Westinghouse brake pump rods, boiler feed pump spindles, water gauge fittings, blow-off cocks, regulator valves, feed check valves, injectors, and whistle valves.

Austenitic Stainless Steels

Owing to its resistance to atmospheric corrosion, severe in railway service, and the good finish that can be given to austenitic stainless steel, it is being used extensively in passenger cars for purely ornamental fittings, both for exterior and interior parts, where it is desired to combine utility with a pleasing finish. A striking example of the use of stainless steel for external decoration is on the L.N.E.R. streamlined Pacific locomotive No. 2512 *Silver Fox*. The whole of the exterior bright fittings on this engine, including an embossed and chased figure of a silver fox attached to each side of the engine below the name plate, were made from Silver Fox stainless steel.

On the same engine there are also stainless steel boiler clothing bands, hand rails and pillars, exhaust pipe for vacuum ejector, cab window frames, side screen frames, maker's name plates, coupling rod end covers, and other minor parts. The effect of the bright burnished stainless steel parts against the matt grey ground colour is particularly pleasing, and the adoption of stainless steel will effect a saving of labour in cleaning.

Austenitic stainless steel and, to some extent, stainless iron, are used extensively in kitchen cars, also for lavatory fittings, and more recently for purely internal decoration in passenger coaches. The materials may be fabricated without difficulty by the usual metal working processes. For certain parts in the kitchens it is perhaps more suitable than any other material, as it is easily cleaned with soap and water and is untarnishable by foods and condiments. In sheet form austenitic stainless steel is easily pressed and spun, and is available in the form of cooking utensils, polished sheets for panelling, table tops, and similar fittings, and can be supplied as castings or forgings for decorative work when necessary.

A further advantage of stainless steel is its freedom from attack by disinfectants, and bright fittings in this material are not tarnished by, for example, the gassing of railway coaches by formaldehyde, a process which quickly discolours bronze or brass fittings. Austenitic stainless steel is adopted in this country almost entirely for decorative parts, utensils, &c., but it is interesting that in the United States it has been used as a structural material.

The original Burlington Zephyr was built entirely from light rolled sections of 18/8 steel welded by the Budd process in lattice girder construction, and plated with sheets of the same material. Further units of this type have been and are being built, and quite recently a standard passenger coach for long-distance service has been delivered to the Atchison, Topeka & Santa Fe Railway, the body of which is fabricated of stainless steel. The process has also been developed in aeroplane design.

The assurance that inaccessible structural members will

not be weakened by corrosion enables the designer to calculate with a lower factor of safety, and it has become almost standard practice to use the 0·1 per cent. proof stress of austenitic stainless steel as a basis of calculations of stress.

Stainless steels cannot, in a general sense, be regarded as easy machining materials,* but the adoption of a few simple precautions enables work to be carried out on a production basis with a remarkably good finish, and these precautions machinists quickly adopt. The martensitic steels are generally put into service hardened and tempered to a tensile strength of 45-55 tons per sq. in., and in this state they are in their best condition for machining. If required harder, it is usual to machine in the annealed or fully tempered state to within a few thousandths of the finished state. The parts are then hardened and lightly tempered to the required tensile strength, and finally ground to size.

When turning or machining this material, the machines and tools must be rigid to avoid chatter. Tools should have a little more clearance and rake than is usual for ordinary steel, and it is essential that cutting should be continuous and with sharp tools. Continuous cutting is important with austenitic steels, particularly when drilling small holes. A short, sturdy length of drill should be used; the material must not be marked with a centre punch, as this results in work hardening the surface. The most satisfactory results are obtained with a hand feed applied gently, continuously and steadily until the hole is completed. It is most important to avoid work hardening or burnishing of the machined surface, as this presents a glass hard surface to the cutting tool upon which it may be difficult or even impossible to start a fresh cut. Practically all the special precautions suggested for the machining of stainless steel have these possibilities in view.

The development of the uses of stainless steel in industry has been phenomenal, and it has been the means of cutting down weight and revolutionising design. It has made possible the commercial adoption of certain chemical processes, and it has presented a new medium for decorative art. Railway engineers and designers were among the first to recognise the advantages of stainless steel. It is hoped that these notes will assist in suggesting further developments, and will be some guide in the selection of suitable types of steel.

* A book issued by the United Steel Cos. Ltd., "The Machining of Silver Fox Stainless Steels," will be found helpful to machinists.

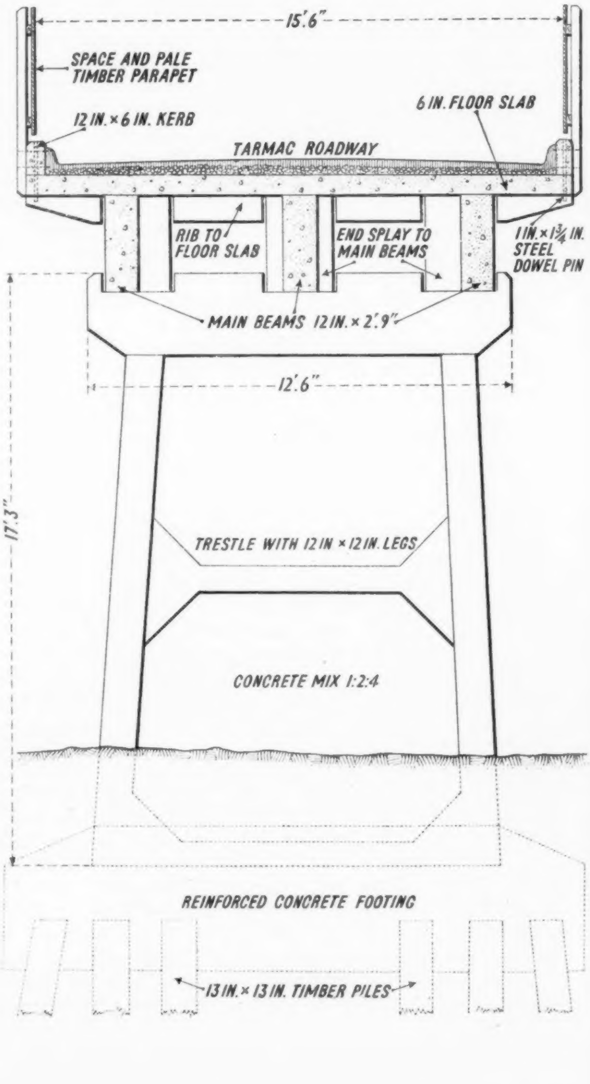
A Precast Reinforced Concrete Highway Bridge

AN interesting type of bridge reconstruction with the use of precast reinforced concrete units has recently been completed by the Great Western Railway near Kerry in Montgomeryshire. The new structure, which is just over 100 ft. long, carries a 15-ft. road over the single line branch from Abermule, and replaces an old timber pile bridge. As it was not possible to provide temporary accommodation for the road during the reconstruction period, the work had to be carried out as expeditiously as possible, and in view of the wet conditions at the site it was decided to construct the new bridge almost entirely in precast reinforced concrete units.

The work of casting these units in the company's concrete depot at Taunton was begun at an early date to ensure full strength before handling, and in all some 80 pieces were cast in specially constructed timber moulds; the units varied in size from 4 cwt. to 7 tons. Each of the main beams was cast with a camber of 1 in. and provided with lifting holes. The whole set was then loaded into a special train of 15 wagons, totalling 155 tons of concrete material, and run from Taunton to the site at Kerry.

The actual erection was carried out with the aid of a 36-ton steam crane in view of the very long reach required to place the end beams and floor slabs in the two side spans. Not a single bolt was required, other than in the timber parapet, each member being wedged into position by its neighbour, and interlocking together so as to make the whole structure rigid. The actual erection of the precast units was completed in four days, which in view of the fact that occupation was required by the Traffic Department for three of these days until after midday fully justified the method adopted.

The advantages to be derived from this type of construction, apart from the salient feature of economy in time of erection, are the natural provision for expansion by the clearance between the component parts of the structure, and the freedom from constructional scaffolding and centring, which would almost certainly encroach on the structure gauge were concreting carried out at the site.



The original timber bridge

The new reinforced concrete bridge

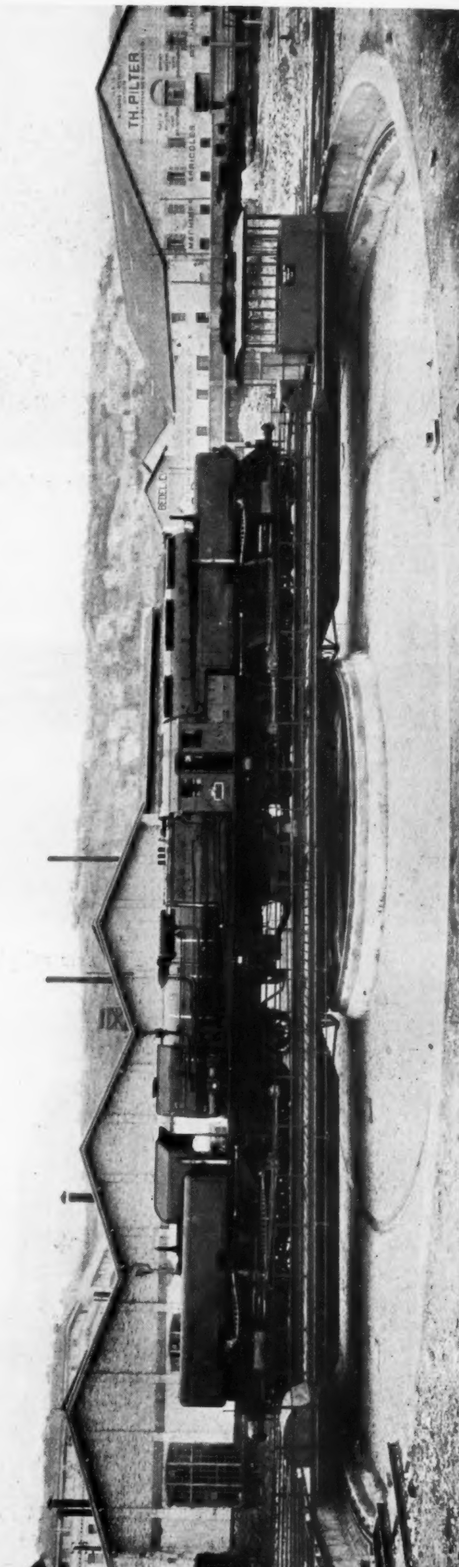
Erecting the pre-cast concrete sections

View of underside of new bridge

A PRE-CAST REINFORCED CONCRETE HIGHWAY BRIDGE IN MONTGOMERYSHIRE, G.W.R.

An unusual view of the new G.W.R. main line third class carriages showing the wide observation windows and deep sliding ventilators

Interior of new waiting room at Waterloo, Southern Railway, with its new furniture (see editorial note on page 546)



A standard gauge Beyer-Garratt express locomotive of the Algerian Railways on a turntable of unusual length. These locomotives, which are turned periodically to ensure even tyre wear, are used in running the heavy express trains between Algiers and Oran and Algiers and Constantine in connection with the C.G.T. services from Marseilles. The speedier schedule made possible by the Beyer-Garratt engines, and the reduction from 23 to 16 hours in the sea crossing between Marseilles and Algiers, following the introduction of the new mail steamer "Ville d'Alger," have effected considerable savings in through journey times

RAILWAY NEWS SECTION

PERSONAL

NORTHERN IRELAND ARBITRATION TRIBUNAL

Under the Northern Ireland Road and Railway Transport Act, the following Arbitration Tribunal has been appointed: Mr. Justice Megaw (Chairman), Mr. W. H. Fitzsimmons, F.C.A., and Mr. J. B. Morrison, J.P. This tribunal will, if necessary, decide the amounts to be paid by the N.I. Road Transport Board for the various passenger and freight undertakings it is taking over.

INSTITUTE OF TRANSPORT

The following member and associate members were elected during February:—

Member

Mr. John Aiton Kay, Chairman and Managing Director of Transport (1910) Limited, and Editor of THE RAILWAY GAZETTE.

Associate Members

Messrs. A. Blanks, A. V. Minter and H. F. Minter, Hay's Wharf Cartage Co. Ltd.; E. G. Cullen, Madras & Southern Mahratta Railway; H. W. Elliott, J. B. Green, and G. Maclean, Pickfords Limited; J. Harrison, L.M.S.R.; W. Nicholls, G.W.R.; and R. H. Petherick, Southern Railway.

From the *London Gazette* of March 13:—Territorial Army, Royal Engineers: Engineer and Railway Staff Corps—Major C. H. Stemp, C.B.E., resigns his commission, but retains his rank, with permission to wear the prescribed uniform (March 14). Major Stemp retired from the position of Superintendent, Southern Scottish Area, L.N.E.R., in March, 1935.

Mr. R. A. Gradwell, sometime a Director of the Great Northern (Ireland), and Strabane & Letterkenny Railways, and Member of the County Donegal Joint Committee, left estate in England and the I.F.S. valued at £149,970 (£137,255 in England).

Sir John Hunter recently retired from the chairmanship of Sir William Arrol & Co. Ltd. after over 50 years' connection with that firm. He has been succeeded as Chairman by Mr. Henry Cunningham. Sir John, however, retains his seat on the board, to which Sir Daniel Neylan has been re-elected.

Major Oscar Loewenthal, General Manager, Entre Rios & Argentine North Eastern Railways, who, as announced in THE RAILWAY GAZETTE of March 13, has been appointed General Manager, B.A.G.S. and B.A. Western Railways, as from April 1, was educated in England and Switzerland.

Major O. Loewenthal,
Appointed General Manager, Buenos Ayres Great Southern and Western Railways

Thereafter he was employed successively as Assistant Engineer with the Tehuantepec Isthmus Railway, Mexico, with the Mexican National Railways, and as Chief Construction Engineer of the Real del Monte Mining Company, Mexico. Later he served with the North-Western Railway of Brazil, the Leopoldina and the Puerto Victoria Railways as Construction Engineer. He was subsequently appointed Chief Engineer and Assistant General Manager of the Madeira-Mamore Railway, Brazil, vacating this position to become General Manager of the Southern São Paulo Railway. His next post was that of General Manager of the Transandine Railway, and in January, 1929, he was appointed General Manager of the Entre Rios and North-East Argentine Railways, the position he now vacates to become General Manager, B.A.G.S. and B.A.W. Railways. Major Loewenthal is Chairman of the Pindapoy Fruit Co. Ltd., and of the Compañia Citricola Centinela Ltda.; Director and representative of the financial committee of the second debenture holders of the Buenos Ayres Central Railway; Manager of the Argentine Eastern Land Company, and Local Director of the Entre Rios & Argentine North Eastern, and Argentine Transandine Railways. During the war he served in France with the Royal Engineers, retiring with the rank of Major.

Messrs. J. X. Murphy and J. P. Goodbody have been re-elected Directors of the Great Southern Railways (Ireland).

We regret to note the death, on March 9, of Mr. George Urquhart, a well known contractor for the Sudan Government Railways construction before the war.

Mr. C. T. Skipper, who for the past four years has been Works Manager, Leyland Motors Limited, has been appointed Works Director to the Daimler Co. Ltd.

We regret to record the death, on March 9, of Mr. John Avis, M.V.O., who retired from the position of Continental Traffic Manager, South Eastern & Chatham Railway, in 1915. He was born in 1851 and educated at a private school in Brighton, after which he was engaged in Continental traffic activities, first with the former L.B.S.C.R. (1871-74) and then with the London Chatham & Dover and S.E. & C.R., becoming Chief Assistant, Continental Department of the latter, in 1899; his designation of Continental Traffic Manager dated from 1911. He held many British & Continental orders, among them those of Chevalier of both the Legion of Honour and of the Order of Leopold, and Member of the Victorian Order, awarded him in 1905.

With regret we note the death, on March 11, of Brevet Lt.-Col. G. I. Phillips, Chairman of the Oxford Tramways Syndicate Limited, that shares

equally with the Great Western Railway the ownership of the City of Oxford Motor Services Limited.

Mr. A. G. Watson, M.Inst.C.E., M.I.Mech.E., M.I.Loco.E., Assistant General Manager (Technical) and Chief Mechanical Engineer of the South African Railways and Harbours, proceeds on leave towards the end of March prior to retirement on reaching the age limit.

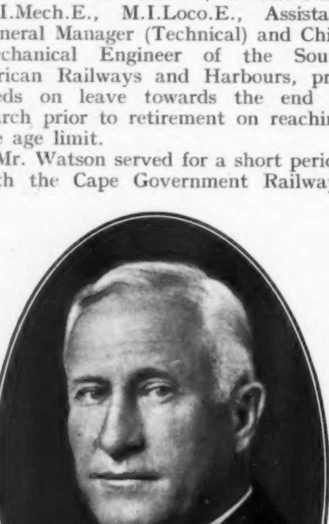
Mr. Watson served for a short period with the Cape Government Railways in the 'nineties, and re-entered the service of that administration as an Acting District Locomotive Superintendent at Naauwpoort in 1901. He was then appointed Draughtsman and Professional Assistant, first at Uitenhage and then at East London, and in 1910 became Assistant Superintendent (Mechanical) at Kimberley, and later also at Mafeking. In the first year of the Great War, Mr. Watson proceeded on active service to South West Africa as a Captain in the South African Engineering Corps. Promotion in the Railway Service took him to Uitenhage in 1922 as Mechanical Engineer, in which rank he also served at Durban. In April, 1928, he was promoted to be Assistant Chief Mechanical Engineer, Pretoria, and a year later he became Chief Mechanical Engineer. It was in November, 1934, that he was appointed Assistant General Manager (Technical), additionally to being C.M.E.

We regret to note the death, on March 13, of Mr. T. C. Humphrey, M.B.E., who retired from the position of Stationmaster, Newcastle Central, in 1932. He was formerly Stationmaster at York, and was awarded the M.B.E. for his services in connection with troop and other mobilisation movements during the war. He was 68 years of age, and had 50 years' service with the former N.E.R. and L.N.E R.

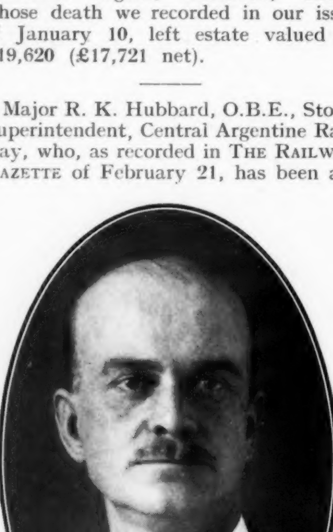
Col. Sir Lawless Hepper, late R.E., sometime Agent, G.I.P.R., India, whose death we recorded in our issue of January 10, left estate valued at £19,620 (£17,721 net).

Major R. K. Hubbard, O.B.E., Stores Superintendent, Central Argentine Railway, who, as recorded in THE RAILWAY GAZETTE of February 21, has been appointed Assistant to the General Manager (as from March 1) was educated at Bethany House School, Goudhurst, and at Brighton Technical College. He was trained as a mechanical engineer with John I. Thornycroft & Co. Ltd., Basingstoke, and was afterwards employed with Halley's Industrial Motors, Glasgow, as Assistant Works Superintendent. On the outbreak of the war, he received a commission in the Royal Army Service Corps, and served as Chief Stores Officer at the Mechanical Transport depot, Rouen, in which capacity he was responsible for the supply of some 70,000 different items of stores required for the maintenance of the 20,000 motor vehicles employed by the British Army in France. He was three times mentioned in despatches and was awarded the O.B.E. After the war Major Hubbard held the following military appointments: Instructor in Mechanical Transport, Aldershot; Staff Captain, Mechanical Transport, War Office; Chief Inspector, Mechanical Transport, India; Member of the Technical Committee, Mechanical Warfare Board. He is an Associate Member of the Institution of Mechanical Engineers; a Member of the Institution of Automobile Engineers, and of the Society of Automotive Engineers of the United States. He was appointed Deputy Stores Superintendent, Central Argentine Railway, in November, 1930, and Stores Superintendent a year later, the post he now vacates to become Assistant to the General Manager.

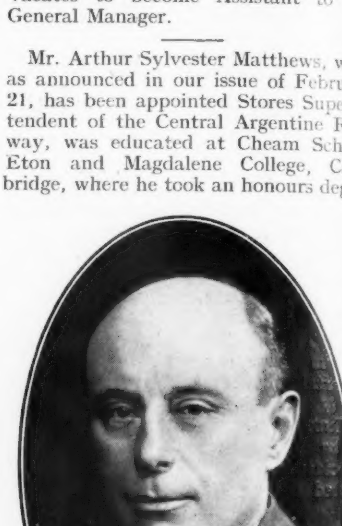
Mr. Arthur Sylvester Matthews, who, as announced in our issue of February 21, has been appointed Stores Superintendent of the Central Argentine Railway, was educated at Cheam School, Eton and Magdalene College, Cambridge, where he took an honours degree in mathematics. He was given a temporary commission in the 13th Reserve Cavalry Regiment in August, 1914, and served in France with the 8th (King's Royal) Hussars from May, 1916, to February, 1919. He was called to the Bar in May, 1919. In 1924 he unsuccessfully contested the Doncaster Division of the West Riding of Yorkshire, in the Conservative interest. From February to September, 1927, he was engaged on a special mission to Colombia, Peru and Ecuador. In 1928, Mr. Matthews was appointed Assistant Secretary to the Central Argentine Railway Company, and in July, 1934, became Assistant to the General Manager at Buenos Aires, whence he now proceeds to Rosario as Stores Superintendent.



Mr. A. G. Watson,
Assistant General Manager (Technical), South African Railways and Harbours, 1934 36



Major R. K. Hubbard, O.B.E.,
Appointed Assistant to the General Manager, Central Argentine Railway



Mr. A. S. Matthews,
Appointed Stores Superintendent, Central Argentine Railway

Mr. H. G. Cabrett, Chairman of the Local Board, Córdoba Central Railway, sailed from Buenos Aires for New York, on February 15, on a prolonged tour, embracing the United States, the Far East, New Zealand, Australia, South Africa and England.

Mr. J. W. Cloud, late Director of the Westinghouse Brake & Signal Co. Ltd., whose death we announced in our issue of January 24, left estate valued at £13,562 (£13,019 net).

QUESTIONS IN PARLIAMENT

London Passenger Fares

Mr. Kelly on March 11 asked the Minister of Transport if he had had a reply from the London Passenger Transport Board and the railway authorities on the claim for suitable travelling facilities at cheaper rates than those now operating for young persons working in London and neighbourhood.

Mr. Hore-Belisha.—Jurisdiction over the fares charged by the board and the railway companies in the London passenger transport area is vested in the Railway Rates Tribunal.

Mr. Kelly asked the Secretary of State for the Home Department, if he had investigated the likelihood of railway and other transport authorities giving special facilities for young people starting work in the early morning or leaving their work at a late hour at night.

Mr. G. Lloyd (Under Secretary) replied.—It is already the practice, when considering any application for an Order authorising two-shift employment of women or young persons, to make inquiries as to the transport facilities available for those living at a distance, and to include where necessary a condition in the Order to enable the Secretary of State to call upon the employer to make special arrangements for the conveyance of such workers where the ordinary transport services are inadequate. No further action seems necessary.

British Money in Argentine Railways

Mr. Kelly on March 12 asked the Chancellor of the Exchequer whether he was aware that the Argentine Government had legislated to reduce railway earnings to $1\frac{3}{4}$ per cent.; what amount of British money was invested in such railways; whether any approaches had been made on the matter; what action had been taken; and what effect this action had had on employment.

Mr. Chamberlain.—The nominal value of British investments in the Argentine railways has been estimated at £270 millions. As regards the remainder of the question, I would refer the hon. member to the answer given by the Parliamentary Secretary to the Department of Overseas Trade on March 2, to which I have nothing to add.

Facilities for Young Persons

Mr. Kelly asked the Minister of Labour if he would state what was the result of his appeal to the railway companies and the London Passenger Transport Board for cheaper travelling facilities at suitable hours for young persons in employment in the area of the London Juvenile Advisory Council.

Lt.-Col. Muirhead (Parliamentary Secretary, Ministry of Labour).—I understand that the London Regional Advisory Council for Juvenile Employment approached the London Passenger Transport Board and the railway companies on the question of cheaper travelling facilities for young persons, but that these bodies have indicated that they are unable to agree to any extension of the existing facilities.

M.Ps' Travelling Vouchers

Mr. Keeling on March 17 asked the Secretary to the Treasury whether he was aware that a notice accompanying the vouchers for railway tickets issued to members requests them to ask for cheap day tickets whenever possible, in order to save expense to the taxpayer, and that such tickets were endorsed with the condition that passengers using them were carried at their own risk in the case of injury; and whether, in the interests of the dependants of any member who might be killed while travelling to or from his constituency, he would arrange either for the request to be withdrawn or for members to be freed from the condition.

Mr. W. S. Morrison.—I am aware of the facts to which my hon. friend refers, but I fear it would not be possible to ask the railway companies to treat Members of Parliament differently from other users of cheap tickets. I should point out that the use of such tickets by hon. members is not obligatory, but at the same time I do not think it unreasonable that they should be asked to avail themselves of travelling facilities at reduced rates when the charge falls on public funds.

Runs by German Streamlined Engines

On February 25, about a week after a speed of 205 km.p.h. (127·3 m.p.h.) had been attained by a German State Railway three-unit articulated diesel-electric set on the Berlin-Hamburg line, demonstration runs for press representatives were arranged over the same route with a Henschel 2-cylinder 4-6-4 streamlined tank engine and a Borsig 3-cylinder 4-6-4 streamlined tender locomotive, of the types described in our issues of August 30 and March 22, 1935, respectively. Both engines were exhibited at the Centenary Exhibition in Nuremburg. The outward journey to Hamburg was made with the Henschel tank engine hauling the 132-tonne 4-coach Wegmann streamlined train set illustrated in our issue of February 21 last. On the return journey the Borsig engine hauled a 275-tonne train consisting of five corridor coaches and a dynamometer car.

On the first run, the train left the Lehrter station, Berlin, at 10.6 a.m., and a speed of 120 km.p.h. (74·6 m.p.h.) was attained at Nauen, after which it gradually increased to 160 km.p.h. (99·4 m.p.h.). Wittenberge was reached within the hour, and a short stop made. Leaving again the speed was increased to a maximum of 175 km.p.h. (108·7 m.p.h.), and Hamburg (Hauptbahnhof) was reached in 2 hr. 32 min. from Berlin, the train having covered the distance of rather more than 280 km. (174 miles) at an average speed of nearly 113 km.p.h. (70·2 m.p.h.).

The return trip with the Borsig locomotive started at 3.37 p.m.; a speed of 190 km.p.h. (118·1 m.p.h.) was reached on the run to Wittenberge, and two or three times thereafter. With two stops, the journey was accomplished at an average speed of 116 km.p.h. (72·08 m.p.h.).

Two days later, on February 27, the trips were repeated to the same timetable for the benefit of the foreign press. Both series of journeys were for propaganda purposes. The engines concerned are still undergoing tests, which will continue for another six months or so before they go into regularly scheduled service.

L.N.E.R. Signal and Telegraph Engineers

Mr. C. J. Brown, Engineer, London & North Eastern Railway, Southern Area, presided last Friday at a supper and concert held at the Manchester Hotel, Aldersgate Street, London. The gathering was organised by Mr. W. P. Challoner, of the Southern Area Signal and Telegraph Engineer's office, in response to a widely expressed desire on the part of friends and colleagues to wish Mr. F. Downes, late Signal and Telegraph Engineer, Southern Area, a long and happy retirement, and to congratulate Mr. C. Carslake on his appointment as Signal and Telegraph Engineer of the North Eastern Area. During the evening many tributes were paid by various speakers to the two guests of the evening, Mr. F. Downes and Mr. C. Carslake.

Those present included Mr. A. E. Tattersall, Signal and Telegraph Engineer, Southern Area; Mr. H. Hall, Engineer's Accountant; Mr. B. P. Fletcher, District Engineer, Cambridge; Mr. A. J. Grinling, District Engineer, Peterborough; Mr. T. H. Seaton, District Engineer, Stratford; Mr. C. F. Slade, District Engineer, King's Cross; and Mr. C. Hills, Signal and Telegraph Engineer's office. Visiting friends included Messrs. Austin, Boot, Castle, Glenn, Hogben, Kay, Lascelles, Minett, Painter, Proud, Punter, Rickett, Smith, Sykes, Towell and Williams, and a large number of inspectors from the Southern Area districts.

During the evening Mr. Carslake was presented with a gold watch, and on behalf of Mrs. Carslake was asked to accept a silver salver. These tokens were subscribed for by his colleagues. Some few weeks ago in the Board Room, Liverpool Street, a formal presentation to Mr. Downes was made by Mr. C. J. Selway, Passenger Manager, L.N.E.R. (Southern Area).

Locomotive Testing

Report of a lecture by Prof. Dr.-Ing. Felix Meineke to the German Circle in London

There was a large attendance at the meeting of the Engineers German Circle on March 16 to hear Professor Dr.-Ing. Felix Meineke's lecture on "Versuche mit Dampflokomotiven" (Locomotive Tests). Mr. H. N. Gresley, C.B.E., President of the Institution of Mechanical Engineers, was present at the opening of the meeting and expressed his satisfaction at the continued success and usefulness of the meetings. In welcoming Professor Meineke he referred to the proposal to establish a testing plant in this country which he hoped would fructify. Professor Meineke's invention for enabling two-cylinder locomotives to be tested at the highest speeds on such a plant, which he would describe in his lecture, was of great interest, and he was glad to hear that an account of the lecture in English would appear in the technical press.

At the outset of his lecture Professor Meineke differentiated between two main aims of locomotive testing. The first is to meet the requirements of the traffic department who wish to know whether a certain schedule can be maintained over a given route with a given train weight. The second is to provide the locomotive builder with scientific data. Formerly, as in Stephenson's time, locomotive design was purely intuitive; then followed rule-of-thumb methods and the engineer's pocket book, aided by much practical experience. The modern locomotive builder, however, needs safer foundations for his designs; for example, data regarding steam temperature in the boiler and cylinders, and the losses in the cylinders. Scientific locomotive research concerns itself increasingly with such fundamental questions. Today locomotives with steam pressures of up to 300 lb. per sq. in. can be designed fairly exactly according to calculation, though there remains some uncertainty regarding superheat and draught in the boiler. But this is chiefly by means of empirical methods, and progress is possible only by means of more scientific data regarding old types and good intuition in the design of new types.

Turning to methods of testing, Professor Meineke first dealt with the dynamometer car and pointed out that if the gradient profile of the route of the test is uneven nothing can be constant and it is impossible to obtain any reliable measurements. For scientific purposes, *i.e.*, the obtaining of data on which calculations can be based, it is essential that drawbar pull and speed do not vary. Long stretches of track with even gradients are therefore necessary, and the methods of Lomonosoff in Russia, Czeczott in Poland, and of the German State Railway, depend on the availability of such stretches. The German method in which brake locomotives are used in conjunction with a dynamometer car, but no other vehicles, have the advantage that the prescribed test conditions can be quickly reached since the brake locomotives at first help to accelerate the train. Tests of this kind are of the greatest use for calculating the most economic train schedules, and are particularly valuable for large railways where locomotives of similar type are used on various routes. The results obtained also provide the designer with reliable data on which to base his main calculations. The original methods evolved by Lomonossoff have thus been developed to a high pitch of perfection in Poland and Germany.

For boiler investigations only, stationary tests can be carried out by removing the valves. This method has the disadvantage, however, that evaporation proceeds rather more vigorously than in normal running since the blast is more effective on account of the improvement of the condition of the exhaust steam through throttling. In order to obtain constancy of all the test conditions it is a great convenience to transfer the test from the track to the laboratory. Hence the origin of testing plants.

Professor Meineke then described briefly the testing plants that had been built, and the various methods of braking adopted. Most of these plants soon became obsolete on account of the growing power of locomotives, and even modern testing plants are often unable to deal with powerful locomotives at very high speeds such as are today of particular importance. The reason for this is the serious effect of the unbalanced forces of a two-cylinder locomotive which set up recoil, nosing and rolling. The rolling is harmless, and nosing scarcely dangerous, because it is mostly taken up by the bogie return springs or running axles and is damped through friction. The recoil effect, is, however, extremely detrimental. This is the phenomenon which produces the well-known jagged drawbar-pull line in the dynamometer car. It is caused by the unbalanced reciprocating forces of the motion of the locomotive and is limited in amount. But when the recoil cannot take place freely, as on a testing plant, very large forces arise which increase with the square of the speed. Not only are these forces transmitted through the dynamometer to the foundations, but they seriously impair the accuracy of measurement. The whole testing plant is so violently shaken that large two-cylinder locomotives cannot be run at much higher speeds than 50 m.p.h.

In order to overcome this difficulty Professor Meineke has made use of an old and very simple means of balancing the reciprocating masses. It consists of a pair of weights revolving in opposite directions. Fig. 1 shows two such opposed pairs of weights, which lie approximately in the vertical plane of the cylinders and revolve at the same speed as the driving wheels. The weights are built up of separate plates so that they can be adjusted to the unbalanced weight of the motion of the locomotive under test. Both pairs of weights are carried on shafts which are coupled together by toothed wheels. The shafts are carried in a frame suspended through a spring from the crane and fastened, after removal of the buffers, to the buffer beam of the locomotive. Thus only horizontal forces are transmitted to the locomotive.

The apparatus is driven from the driving wheels hydraulically by four single-acting pistons at 90 deg. working through a slide-block on a crank-pin. Water, not oil, is the working fluid since this gives the lowest friction loss, and since all the cranks run in roller bearings, very little power is absorbed even at high speeds. Fig. 2 shows the motor whose crankarm is turned by means of a connection to a coupling rod.

At high speed a pressure of 280-400 lb. per sq. in. is set up in the pipes through acceleration of the water. In order to avoid cavities due to the loss

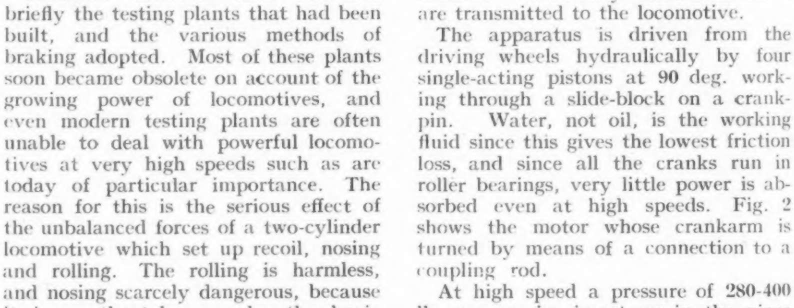


Fig. 1—Device for balancing reciprocating masses to make possible the testing of two-cylinder locomotives at high speeds on testing plant

of water through the safety valves or by leakage, small suction valves are provided on each pipe which connect with the main water pipes. These also serve for filling the pipes when they are newly installed, the air being expelled through a small valve at the highest point of the water cylinder. The four pipes are directly attached to the motor, but at the balancing apparatus short lengths of hose are inserted to take up small movements. This apparatus can be added to an existing testing plant and enables two-cylinder locomotives to be tested at the highest speeds.

Finally, Professor Meineke compared the dynamometer car and testing plant methods. Road tests under constant conditions can give scientific data. For traffic purposes they have the advantage that the useful drawbar pull is directly measured and that the cooling effect of the atmosphere (both harmful as well as useful) as well as its resistance are included. The test plant, on the other hand, is independent of traffic conditions and therefore specially valuable for scientific investigations. The drawbar pull must be calculated, and at high speeds a wind tunnel is necessary to complete the data. The plant can be made adaptable to various gauges for the purpose of testing locomotives for export. But the capital cost is very high, and it may be said that the dynamometer car is necessary, whilst the test plant is a luxury.

In the ensuing discussion it was pointed out that there appeared to be a difference between the experience of the French and the Germans in the matter of the relative costs of testing on the road and on the testing plant. In reply it was made clear, by Professor Meineke and other speakers who had had experience of road testing by constant-condition methods, that irregular road tests, each requiring special preparations and occasioning possibly unforseen contingencies, might well be more expensive than a single test on a test plant continuously in use throughout the year. But it was emphasised that properly organised road tests carried out as a matter of routine would be cheaper than stationary plant tests and could give equally reliable results so far as general performance data are concerned.

Professor Meineke was asked if the German State Railway had considered the question of publishing the results of its tests, in view of the great need of reliable published data on the lines of the Bulletins of the Pennsylvania RR. He replied, however, that the German authorities had maintained a policy of silence. In answer to subsequent questions two interesting facts were mentioned. A circular track for testing locomotives continuously, exists near Moscow. The German State Railway has recently established the importance of insulating the outside cylinders of locomotives on account of the effect of the air stream passing over them on the engine performance.

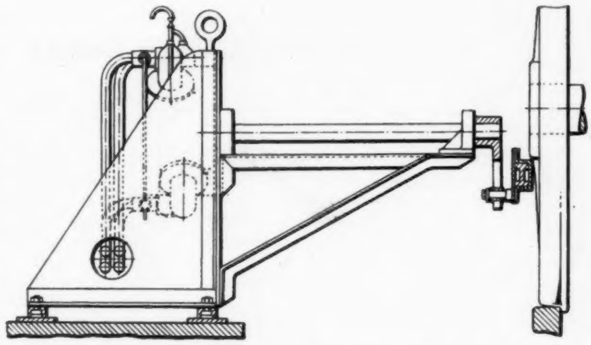


Fig. 2—Method of driving balancing device shown in Fig. 1

RAILWAY AND OTHER MEETINGS

Isle of Man Railway Company

The 66th annual general meeting of the Isle of Man Railway Company was held in the company's offices, Douglas, on Wednesday, March 4, Mr. J. W. Hyde (Chairman of the company) presiding.

The Chairman, in moving the adoption of the report and accounts, said that in 1935 on revenue account the receipts were £50,090 and expenditure was £39,345, leaving a balance of £10,745 gross profit to be carried to net revenue account. These figures, compared with 1934, showed a decrease of £931 in receipts and an increase of £90 in expenses. Passenger traffic showed an increase of £870, which was mainly in the summer season. Goods traffic, however, showed a decrease of £1,628. This decrease was not in ordinary goods traffic, which in fact showed an increase, but in heavy traffic such as bricks, stone, sand, &c., which showed a considerable increase in 1934. For the past two or three months, however, the total volume of this particular traffic had considerably improved. Parcels traffic showed a decrease of £127, which was accounted for by the shorter season.

During the year 790,435 passengers (excluding season tickets) were carried, an increase of 37,363 compared with 1934. Train mileage was 263,040, an increase of 3,268 miles, mainly due to the running of a special train from Douglas to Peel and Ramsey during the busier part of the season. This train was scheduled to leave Douglas at 10.20 a.m. and due to arrive at Peel and Ramsey at 10.50 and 11.20 a.m., respectively, being non-stop at all intermediate stations except St. Johns. It was highly popular and contributed in no small degree to the increase in passenger traffic. The approximate distribution of each £1 of the total revenue for 1935 was: Salaries and wages, 10s. 7d.; coal, 1s. 5¾d.; other materials, 1s. 3d.; rates and sundry items, 1s. 1¾d.; reserve and renewal, 6½d.; carry forward, 6d.; debenture interest, 2s. 6¾d.; dividends, 1s. 11¼d.

With regard to road transport the position was entirely different from that in England, where regulation and control of road transport had been a matter for special legislation. Only the other day it had been admitted by certain members of the trade itself that the number of hackney vehicles licensed was 25 per cent. greater than it should be. There were instances of charabancs operating between Douglas and Ramsey at a fare of 1s. return. The excess of hackney vehicles also gave rise to uneconomic competition during the summer months when this company had to make good the long winter drain on its resources. Some measure of control in regard to passenger fares in the Island was, he suggested, long overdue. The competition of irregular motor lorry services was a factor of equal, if not greater, importance. Some of these vehicles entered into competition with the legitimate transport services merely as a side line to their own businesses. In other cases varying rates were charged on the outward journey, and return loads were taken at any figure obtainable regardless of the cost of working. There were no restrictions whatever in the Island in regard to the use of motor lorries for goods transport. Some measure of regulation and control should be applied in the use of public roads for haulage of goods for reward, where the needs of the public were met as adequately and reasonably by the old form of transport as by the new.

Replying to questions, the Chairman said it had been suggested that the Isle of Man Road Services should be separated from the railway company. He would point out that this bus company was a railway concern. It was entirely subsidiary to the railway, its earnings belonged to the railway, and it was a very satisfactory investment.

The report was adopted.

Indian Railway Budget

By our correspondent in India

On February 17, Sir Zafrulla Khan, Member for Railways and Commerce, and Sir Guthrie Russell, Chief Commissioner of Railways, introduced the Railway Budget in the Legislative Assembly and the Council of State respectively. The principal points which emerge from their speeches are that the periodical statistics of approximate gross earnings issued by the Railway Board had prepared the public for the gloomy picture unfolded in the central legislatures, and the financial results of 1934-35 actually turned out worse than was anticipated in February, 1935, owing to poor railway receipts during the last six or seven weeks of the financial year. Thus the deficit for 1934-35 amounted to Rs. 5 crores, or Rs. 75 lakhs more than was expected.

The revised estimates for 1935-36 [as roughly foreshadowed in The Railway Gazette of February 7 last—Ed.] place the total traffic receipts at Rs. 90 crores against Rs. 93·5 crores in the original budget. The working expenses, including depreciation, are also revised from Rs. 64·43 crores to Rs. 64·01 crores. Taking into account the balance of miscellaneous receipts and expenditure, the net earnings in the revised estimate of net revenue are estimated at Rs. 26·83 crores in place of Rs. 29·75 crores originally expected. The interest charges amount to Rs. 31·37 crores, and the net deficit for the year, originally estimated at Rs. 1·90 crores, is now expected to amount to Rs. 4·54 crores, or only about half a crore less than the deficit in 1934-35. The deficit, which includes a loss of about Rs. 2 crores on strategic lines, will be met by borrowing from the Depreciation Fund which, at the close of the year, will stand at just under Rs. 9 crores. The total borrowings from the Depreciation Fund to meet deficits will reach the high figure of Rs. 32 crores.

As the anticipations of traffic for the current year have been falsified, the authorities are more cautious in their estimates for 1936-37. The total traffic receipts on State lines, both commercial and strategic, are placed at Rs. 91·25 crores, against Rs. 90 crores in the current year. This estimate assumes an improvement of a crore from alterations in rates and fares that have been introduced or are intended to be introduced, but in volume of traffic it assumes that, in 1936-37, the railways will recover only the ground lost in the current year. The total working expenses, including depreciation, are estimated at Rs. 64·5 crores, representing an increase of half a crore in the ordinary working expenses. The net revenue, including miscellaneous receipts, will then be Rs. 27·67 crores, or Rs. 84 lakhs more than in the current year. This figure will fall short of the total interest charges by Rs. 3·44 crores, and a loan to this extent will again have to be taken from the depreciation fund. The actual balance in the fund at the end of 1936-37 is expected to be about Rs. 11·75 crores.

The programme of capital expenditure for next year is necessarily more restricted than that for 1935-36, and its total expenditure on works is only Rs. 11·50 crores [as anticipated in these columns of the issue of February 28—Ed. *R.G.*]. The provision under capital expenditure during 1936-37 is reduced to Rs. 10·25 crores, new construction being practically confined to the Megna bridge on the Assam-Bengal Railway: only 750 general service wagons are to be purchased. Most of the other works are in the nature of replacements and improvements of the open line, such as renewal of track, strengthening of bridges and rolling stock.

The budget speeches of the Hon. Member for Railways and Commerce and the Chief Commissioner of Railways dealt with the grave situation caused by the successive deficits since 1930-31. The main reasons for the falling off in earnings were given as the world depression, with its effect on commodity prices, the striving after self-sufficiency in all countries, and competition from roads, river, and sea. To these were added the effect on working expenses of labour legislation and improved conditions for the staff.

Statistics were given to show how the collapse in the price of cotton had led to a decrease in the area under cultivation and to the substitution of food crops, thus also affecting food crop imports. The effect of world conditions and drop in prices on traffic in wheat, oilseeds and jute were also explained.

Protective tariffs for new industries had substituted short-lead traffic for long-lead traffic. On the North Western Railway alone the loss from this substitution was estimated at Rs.50 lakhs per annum.

The railways were now losing about Rs. 3 crores to the roads annually. Although the loss has so far been confined mainly to passenger traffic, signs were not wanting that valuable goods traffic, such as piecegoods, was being lost to the roads. Much of the money available for roads was being spent on the improvement or reconstruction of roads parallel to railways, although there were vast areas without road or rail transport.

In regard to the larger items that have added to the working expenses of the railways, the application of the Washington and Geneva Conventions to Indian railways had cost about Rs. 50 lakhs per annum to railway revenues. During the years of prosperity, the Government of India rightly decided to spend a portion of the railway surplus on amenities for the lower paid staff.

The budget speech continued by pointing out that an improvement in world conditions, of which there were faint signs, would be reflected in India, and a gradual increase of traffic in the commodities affected might reasonably be expected. As regards the problem of self-sufficiency, the Railway Member said he saw little chance of recovering lost traffic, but the development of industries in India would presumably enrich the country, and the railways should share in the general prosperity.

Dealing with obstacles to proper co-ordination of road and rail transport by reason of the railways being the concern of the Central Government, and the development of roads and the control of motor transport that of Provincial Governments, the Railway Member pointed out that the finances of the provinces were dependent, to a large extent, upon the prosperity of the Central Government. Over Rs. 750 crores of public money were invested in Indian railways. If the central revenues were faced with the prospect of having to finance an unremunerative system of railways, their capacity to contribute towards the resources of the provinces would be correspondingly reduced.

Sir Zafrulla Khan referred to recent reports on labour conditions in various industries to show that the railways would be justified in calling a halt, at least for some time, in the liberalisation of rules relating to the hours and conditions of work, and to the grant of further privileges to the railway staff.

The decision of the Government of India to make travelling without tickets a penal offence was welcomed, as the deterrent effect of the measure was expected to raise railway revenues by about Rs. 50 lakhs per annum. The Railway Member also sought the co-operation of the public in suppressing corrupt practices among the railway staff, such as under-weighment and the misdeclaration of goods—practices which occasioned considerable leakage in railway revenue.

In spite of a deficit budget, the financial position of the Indian railways, it was emphasised, was not unsound. The net return on capital on Indian railways was higher than in most other countries. During the years 1933-34 and 1934-35, Indian railways earned 3·40 per cent. and 3·64 per cent. on the capital at charge. Given rectification of the points mentioned in the budget speeches, the Chief Commissioner of Railways considered that there was a fair chance that the financial position of the Indian railways might gradually improve, and that within about five years they would again be without a deficit.

NOTES AND NEWS

Egyptian Railways Western Extension Completed.—As anticipated in the Overseas columns of our issue of March 13, the extension of the Mariut line westwards along the coast from Alexandria was completed to Mersa-Matruh on March 15.

Deptford Bridge Renewal.—The Deptford Creek lift bridge, which carries the London Bridge–Greenwich line of the Southern Railway over the Surrey Canal, is now undergoing complete renewal. The work is being carried out at weekends, and at times necessitates the complete closure of the line on Sundays.

Railway Convalescent Homes: Spring Banquet.—The spring banquet of the Railway Convalescent Homes will be held in the Wharncliffe Rooms of the Hotel Great Central, Marylebone, on Thursday evening, March 26, at 6.15 p.m. for 6.45 p.m. The chair will be taken by the President, Mr. Robert Holland-Martin, C.B., Chairman of the Southern Railway.

Road Accidents.—The Ministry of Transport return for the week ended March 14 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year :—

	Killed, including deaths resulting from previous accidents		Injured	
England ...	80	(86)	2,694	(2,511)
Wales	2	(4)	86	(80)
Scotland ...	7	(15)	255	(279)
	89	(105)	3,035	(2,870)

The total fatalities for the previous week were 97, as compared with 94 for the corresponding period of last year.

L.M.S.R. Punctuality Test.—The L.M.S.R. reports that remarkably successful results have attended a punctuality test carried out during Tuesday and Wednesday of last week, when the time-keeping of approximately 13,500 express, local, and electric trains per day was specially observed. The test revealed an overall average of 96·9 per cent. trains punctual on the first day, and of 97·9 per cent. punctual on the second day. On the L.M.S.R. system in Scotland express passenger trains attained 100 per cent. punctuality on the first day, while Scottish local trains were also 100 per cent. punctual on the second day. In these tests lateness up to 5 min. is accepted as punctuality.

L.N.E.R. (General Powers) Bill.—Application is being made to Parliament by the L.N.E.R. for leave to introduce into its General Powers Bill an additional provision which will empower the Minister of Transport to provide by order that such of the provisions of the Roads Act, 1920, the Road and Rail Traffic Act, 1933, and the Road Traffic Acts, 1930 to 1934, or any regulations made thereunder as are in his opinion inappropriate, shall not apply to any motor vehicles or trailers which the company may use over and along that part of Nelson Street in Hull which lies between Pier Street and Queen Street for transporting goods and merchandise between the Victoria Pier and the company's premises on the north side of Nelson Street.

Southern Railway Bill.—The Southern Railway Company is applying to Parliament for leave to insert in its Bill for this Session additional provisions to authorise : (1) the construction of a deviation 4 fur. 4·46 chains in length—commencing in Twyford and terminating in the City of Winchester—of a portion of the Didcot, Newbury & Southampton Railway ; and (2) in connection with such deviation, the construction of new roads and the acquisition of lands, with special powers as to entry and compensation.

New Streamlined Trains, C.M., St. P. & P.RR.—Two new Hiawatha streamlined trains are being built for service on the Chicago, Milwaukee, St. Paul & Pacific Railroad. Lighter in weight than last year's Hiawathas, the new trains will have three parlour cars, a full-size 40-seat diner, three coaches, and a taproom car, as on the present trains in this fast series. Cars will be of the same general design as at present, except that the last parlour car will have an observation lounge and solarium space.

Sentinel Railcar on Westerham Branch.—On March 2 the Sentinel-Cammell railcar, which has hitherto worked on the Brighton-Dyke branch of the Southern Railway, was transferred to the London East Division and placed in service on the Westerham branch. The journey time with this vehicle has been reduced to 10 min., as compared with 13 min. before, and the push-and-pull trains have had their time cut to 11½ min. At certain times of the day the railcar runs to and from Tonbridge for refuelling, and by conveying passengers between Sevenoaks and Tonbridge provides a useful additional connection with the electric service from London.

L.N.E.R. Timetable Type Standardisation.—The Spring issue of the large L.N.E.R. timetable book, dated May 4 to July 5, has just been published and the whole of its 475 pages have been set in Gill Sans, with every figure and letter of newly cast type. In 1930 the L.N.E.R. decided to employ the famous type designed by Mr. Eric Gill as the standard for all printed matter, and later for painted notices and signs at stations. The existence of a printing contract, then still having some years to run, prevented the immediate adoption of this face of type for the company's large timetable, but the expiry of this contract has now cleared the way for the change over to be made. Another new feature is the introduction in the main line tables of an arrow down each column opposite the names of stations through which trains run without stopping. This enables the user of the timetable readily to trace the route of a through train without being confused by connecting train times shown in the same column.

A Devon General Absorption.—As from the beginning of this month, the Devon General Omnibus and Touring Co. Ltd. (associated with the G.W.R. and S.R.) has taken over the bus services of Milton's Services (Crediton) Limited. The latter company was incorporated on October 2, 1931, to take over a small existing proprietary business.

Lunch Service in Canadian Carriages.—As from February 1, lunches from the dining cars are available for coach passengers on transcontinental trains of the Canadian National System. The new plan is effective on trains 1, 2, 3 and 4, operating Halifax-Montreal, Capreol-Winnipeg-Saskatoon, and Edmonton-Vancouver. Food available includes sausage rolls, meat pies, sandwiches, hard-boiled eggs, bread and butter, pie, coffee and milk, which are prepared in the ordinary dining cars.

The Brussels Nord-Midi Junction Railway.—At the request of the Belgian National Railways Administration, an engineer of the German State Railway recently exhibited in Brussels a film of the work now in progress in Berlin on the new north-south underground railway. The film was accompanied by a commentary in French. As we have already recorded, the Nord-Midi junction line in Brussels is now in hand. Brief details, with a sketch plan showing the section of the Brussels line which will be in tunnel, were published on page 358 of our issue of February 21.

Axle Counting System on the L.N.E.R.—For some time past the L.N.E.R. has been experimenting in its Southern Area with an axle counting apparatus provided by the Standard Telephones & Cables Limited. It is installed at Silvertown for the protection of single line traffic while deepening of the tunnel is being undertaken, and has been in service for some months. Apart from one or two unforeseen incidents in which failures on the right side occurred, it has functioned satisfactorily. Experiments carried out at Liverpool Street station, No. 4 platform, emphasised certain difficulties in connection with platform working where reversal of traffic over the same treadle took place, but this has been remedied by the application of a directional-type treadle, which is now working very well. At Southgate, where the apparatus has been tried in connection with high speed traffic, including the Silver Jubilee train, it has functioned satisfactorily, correctly registering the number of axles at speeds up to 92 m.p.h. This installation has been arranged by the Standard Telephones & Cables Limited with the

co-operation of the L.N.E.R. specially for the development of a suitable treadle for high-speed trains, and the present stage of such tests indicate that these requirements can be met.

Closing of Durran Hill Shed, Carlisle, L.M.S.R.—As a measure of reorganisation, the former Midland Railway shed at Durran Hill, Carlisle, was closed early in February. The 30 engines stationed there have been distributed between the Kingmoor and Upperby sheds at Carlisle.

Railway Wages.—A further conference took place on March 18 between the railway general managers and the three railway trade unions. The claim of the unions for the abolition of the deduction of 2½ per cent. from all earnings and for the readjustment of certain conditions of service as determined by Decision No. 119 (dated March 5, 1931) of the National Wages Board, was again discussed, and a further meeting was arranged for March 25.

Air-Conditioned Trains in Canada.—The air-conditioning equipment for C.P.R. expresses to which we referred in our issue of February 28 will be in use in sleeping, parlour, and lounge cars on the principal trains of several important routes this summer. Air-conditioned sleepers and parlour cars will run on Toronto-Montreal, Detroit-Windsor-Toronto, and Chicago-Toronto-Montreal services. Sleeper and lounge cars will be air-conditioned on the Chicago-St. Paul-Banff-Vancouver service, and sleepers and lounge observation cars on the Montreal-Toronto-Vancouver service.

New distinctive type of L.M.S.R. signal with black and white striped tubular post, now replacing older patterns

Travel Facilities for Traders.—In our issue of February 28 it was stated that traders' season-ticket rates are about 25 per cent. less than ordinary season-ticket rates; in fact, however, while the standard scales of charges are on this basis, the present chargeable rates are even more favourable as, generally speaking, they represent a reduction of about 40 per cent. from the ordinary season-ticket rates.

Southern Railway "Queen Mary" Excursions.—All the special trains from London and the South Coast to Southampton and Portsmouth to witness the arrival of the *Queen Mary* on March 27 will have restaurant cars for the service of meals and light refreshments. Similar excursions have been arranged on four subsequent days to enable visitors to see the ship while she lies in the King George V graving dock.

New Bus Station and Garage at Norwich.—On Tuesday afternoon next at 3.30 the Lord Mayor of Norwich will open the new garage and bus station in Surrey Street, Norwich, which has been built by the Eastern Counties Omnibus Co. Ltd. In order to make connections, some services will continue to use the bus station in the forecourt of Norwich (Thorpe) L.N.E.R. station, but the majority are to be transferred to Surrey Street.

Grand Trunk Stockholders' Claim.—The Judicial Committee of the Privy Council began on Monday, March 16, the hearing of two consolidated appeals by Mr. G. P. Lovibond, on behalf of himself and the registered holders, on January 18, 1923, of first, second, and third preference stocks and of ordinary stock of the Grand Trunk Railway Company of Canada. He claimed, *inter alia*, a declaration that the transfers of these stocks to the Minister of Finance under an Order in Council of January 19, 1923, were invalid and that the register of stockholders should be amended accordingly. It will be remembered that these stocks were expropriated without compensation in 1919 by the Government of Canada. The hearing was continued on Tuesday and yesterday.

Fatal Accident to Platelayers at Preston, L.M.S.R.—A Ministry of Transport inquiry was opened at Preston on March 17 by Mr. J. L. M. Moore into an accident on March 11 by which four platelayers lost their lives. Mr. Moore said that the Ministry viewed with very deep concern this particular accident. It was one of the worst of its kind that had occurred in recent years, and he thought that it should be held in private so that the men would feel in a position to speak absolutely freely. He added that Lt.-Col. A. H. L. Mount, Chief Inspecting Officer of Railways, had intended to be present at the inquiry, but was prevented at the last moment. At the inquest on March 13 it was stated that smoke and steam from the Fylde Coast Express obscured the approach of the 8.28 a.m. Blackpool-Liverpool train travelling in the same direction on a parallel line about a mile from Preston. Two large gangs were working on the line, and the men had stepped clear of the first train when the second ran into them. The jury expressed the hope that some system of signalling might be introduced which would obviate the risk when two trains were running close together.

Transport in Relation to Town Planning.—Mr. F. W. Wheddon, District Passenger Manager, Manchester, L.N.E.R., recently read a paper with the above title to the L.N.E.R. (G.C. Section) Debating Society. Mr. Wheddon took as his example the Whythenshaw Garden City, Manchester, which is at present without conveniently situated railway facilities. The district therefore suffers from road traffic congestion, and complaints are made at the high fares on the services of the Manchester City Transport Department. Mr. Wheddon emphasised the importance of taking adequate notice of the provision of railway transport in launching new garden city schemes.

Smart Work on the Bristolian, G.W.R.—An unusual run was made by the down Bristolian on March 11. Owing to a minor defect, the engine, No. 6015 *King Richard III*, had to be changed at Reading for No. 2937 *Clevedon Court* of the 2-cylinder, 4-6-0 type, but so smart was the latter's running that the 82·3 miles from Reading to Bristol were covered in 72½ minutes, start to stop, in spite of slight signal checks from Steventon to Wantage Road, and delays approaching Chippenham and into Bristol, which reduced the net time to about 69 minutes. The total time occupied from London to Bristol was 117¼ minutes, including a bad relaying slack at Slough, and 7 minutes standing at Reading. The driver (throughout) was Jones, of Old Oak Shed, and the load the usual seven vehicles, or 216 tons tare.

Institute of Transport Congress.—The 1936 Congress of the Institute of Transport will be held at Birmingham from May 20 to May 23, with its headquarters at the Queen's Hotel. The Lord Mayor of Birmingham will extend a civic welcome on the opening day. The provisional arrangements include three meetings at the Council House to hear papers by Mr. A. C. Baker (General Manager, Birmingham Corporation Tramway and Omnibus Department) on "Municipal Passenger Transport (May 20): by Mr. H. W. Payne (Principal Assistant to the Chief Goods Manager, G.W.R.) on "The Function of the Trader in an Efficient System of Transport" (May 21); and by Mr. E. S. Herbert on "Second Thoughts on the Road Traffic Acts" (May 22). Visits

have been arranged to Crewe works, L.M.S.R., and to the G.W.R. goods stations at Wolverhampton, as well as to the works of Morris Commercial Cars Limited, the Grand Union Canal, the Tyburn Road depot of the Birmingham Corporation and Tramway Department, and the Witton works of the General Electric Co. Ltd. On the final day there will be a motor coach excursion to Lilleshall Hall, while social functions have been arranged for the evenings of the first three days of the congress.

L.M.S. (London) Photographic Society.—The L.M.S. (London) Photographic Society is holding its eleventh annual exhibition this week in the Shareholders' Room, Euston station. The opening ceremony was performed on Monday last by Mr. W. K. Wallace, Chief Civil Engineer, L.M.S.R. For the first time there is an open class for exhibitors in Great Britain and Northern Ireland; this has attracted over 150 entrants. More than 100 entries have been received for the members' class, the exhibitors in which are members of the clerical staff. In all sections a high standard of technique is evident.

L.M.S.R. (London) Amateur Musical Society.—From Wednesday until to-morrow (Saturday) the L.M.S.R. (London) Amateur Musical Society is giving, at the Scala Theatre, four performances of the romantic musical play "The New Moon." Miss Marjorie Fraser takes the part of Marianne Beaunoir, Mr. Arthur Lloyd that of Robert Misson, and Mr. Fred Bishop that of Alexander. This is one of the most ambitious productions undertaken by the L.M.S.R. Amateur Musical Society, and the producers, principals and the ladies and gentlemen of the chorus are to be congratulated on the success of the production, which has been played to large and appreciative audiences. Sir Josiah Stamp is the President of the Musical Society; Mr. W. C. C. Lazenby, Chairman; Mr. W. S. Johnson, Hon. Treasurer; Mr. George Gray, Hon. General Secretary; Mr. Arthur Chapman, Producer; and Mr. Arthur Waller, Hon. Musical Director.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 11th Week			Totals to Date		
	1936	1935	Inc. or Dec.	1936	1935	Inc. or Dec.
L.M.S.R. (6,917 mls.)	£	£	£	£	£	£
Passenger-train traffic...	374,000	372,000	+ 2,000	4,028,000	4,010,000	+ 18,000
Merchandise, &c. ...	498,000	467,000	+ 31,000	5,016,000	4,851,000	+ 165,000
Coal and coke ...	270,000	279,000	− 9,000	3,115,000	2,948,000	+ 167,000
Goods-train traffic ...	768,000	746,000	+ 22,000	8,131,000	7,799,000	+ 332,000
Total receipts	1,142,000	1,118,000	+ 24,000	12,159,000	11,809,000	+ 350,000
L.N.E.R. (6,336 mls.)						
Passenger-train traffic...	250,000	253,000	− 3,000	2,705,000	2,711,000	− 6,000
Merchandise, &c. ...	340,000	328,000	+ 12,000	3,474,000	3,390,000	+ 84,000
Coal and coke ...	251,000	249,000	+ 2,000	2,862,000	2,691,000	+ 171,000
Goods-train traffic ...	591,000	577,000	+ 14,000	6,336,000	6,081,000	+ 255,000
Total receipts	841,000	830,000	+ 11,000	9,041,000	8,792,000	+ 249,000
G.W.R. (3,746½ mls.)						
Passenger-train traffic...	158,000	151,000	+ 7,000	1,697,000	1,690,000	+ 7,000
Merchandise, &c. ...	199,000	187,000	+ 12,000	1,997,000	1,945,000	+ 52,000
Coal and coke ...	107,000	112,000	− 5,000	1,255,000	1,195,000	+ 60,000
Goods-train traffic ...	306,000	299,000	+ 7,000	3,252,000	3,140,000	+ 112,000
Total receipts	464,000	450,000	+ 14,000	4,949,000	4,830,000	+ 119,000
S.R. (2,154 mls.)						
Passenger-train traffic...	237,000	231,000	+ 6,000	2,615,000	2,568,000	+ 47,000
Merchandise, &c. ...	62,500	62,000	+ 500	621,000	637,500	− 16,500
Coal and coke ...	35,500	34,000	+ 1,500	416,000	383,500	+ 32,500
Goods-train traffic ...	98,000	96,000	+ 2,000	1,037,000	1,021,000	+ 16,000
Total receipts	335,000	327,000	+ 8,000	3,652,000	3,589,000	+ 63,000
Liverpool Overhead ... (6½ mls.)	1,055	1,029	+ 26	12,374	11,971	+ 403
Mersey (4½ mls.) ...	3,932	3,823	+ 109	45,753	44,951	+ 802
*London Passenger Transport Board ...	539,500	517,200	+ 22,300	20,064,300	19,700,900	+ 363,400
IRELAND						
Belfast & C.D. (80 mls.) pass.	1,633	1,651	− 18	18,514	18,747	− 233
,, ,, goods	444	468	− 24	5,372	5,031	+ 341
,, ,, total	2,077	2,119	− 42	23,886	23,778	+ 108
†Great Northern (543 mls.) pass.	7,550	8,100	− 550	76,900	74,650	+ 2,250
,, ,, goods	10,850	10,150	+ 700	94,800	90,400	+ 4,400
,, ,, total	18,400	18,250	+ 150	171,700	165,050	+ 6,650
Great Southern (2,076 mls.) pass.	25,323	24,666	+ 657	264,664	252,567	+ 12,097
,, ,, goods	44,297	39,394	+ 4,903	410,012	392,130	+ 17,882
,, ,, total	69,620	64,060	+ 5,560	674,676	644,697	+ 29,979

* 37th week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes
† 10th week.

British and Irish Railways Stocks and Shares

Stocks	Highest 1935	Lowest 1935	Prices Mar. 18, 1936	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	55½	44½	47½	−½
5% Con. Prefce. ...	124	108	119½	−1
5% Red. Pref. (1950)	117	106¾	108½	—
4% Deb.	118½	108	114½	−½
4½% Deb. ...	122	110	117½	—
4½% Deb. ...	129½	118	127½	—
5% Deb.	140¼	130	140½	—
2½% Deb.... ...	82¼	68½	77	—
5% Rt. Charge ...	137	128	134½	—
5% Cons. Guar. ...	136¾	120½	130½	−1
L.M.S.R.				
Ord.	25 5/16	16	22	—
4% Prefce. (1923)	58¼	43½	66	+½
4% Prefce. ...	87½	73½	83½	−½
5% Red. Pref. (1955)	107	97¾	105½	—
4% Deb.	110¼	99½	108½	+1
5% Red. Deb. (1952)	119 11/16	111 5/16	118½	—
4% Guar.... ...	105⅝	95½	103	—
L.N.E.R.				
5% Pref. Ord. ...	15⅞	8¼	10	−½
Def. Ord.	7 9/16	4¾	5½	—
4% First Prefce....	74¾	48	63	−2
4% Second Prefce.	31⅜	16¼	24½	—
5% Red. Pref. (1955)	92¼	71	88½	—
4% First Guar. ...	103 11/16	93	100½	—
4% Second Guar.	98¾	82½	92½	−½
3% Deb.	86	75	81	—
4% Deb.	109¼	98½	106½	+½
5% Red. Deb. (1947)	118½	106½	112½*	−2
4½% Sinking Fund Red. Deb.	112½	108	109½	−½
SOUTHERN				
Pref. Ord.... ...	87½	69⅜	91	−1
Def. Ord. ...	25 13/16	16¾	23	—
5% Prefce. ...	124	108¼	119½	−1
5% Red. Pref. (1964)	117¾	109½	116½	—
5% Guar. Prefce.	136½	121½	132½	—
5% Red. Guar. Pref. (1957)	121¼	112½	116½	—
4% Deb.	116¾	107	113½	−½
5% Deb.	138	130¼	138½	—
4% Red. Deb. 1962–67	115	106½	115½	—
BELFAST & C.D.				
Ord.	9	4	9	—
FORTH BRIDGE				
4% Deb.	111¼	104½	104½	—
4% Guar.... ...	109⅞	104	104½	—
G. NORTHERN (IRELAND)				
Ord.	20	7	16	—
G. SOUTHERN (IRELAND)				
Ord.	57½	14½	45½	—
Prefce.	50	25¼	49½	—
Guar.	88¾	51¼	92¼	—
Deb.	86¼	70	88½	—
L.P.T.B.				
4½% "A" ...	130	119¾	124½	−1
5% "A" ...	139¾	130	134½	−1
4½% "T.F.A." ...	113¾	108	110	—
5% "B"	131½	122¾	127	−½
"C"	109½	91	105	−1
MERSEY				
Ord.	23⅛	9¼	27½	—
4% Perp. Deb. ...	100½	93½	97½	—
3% Perp. Deb. ...	75½	67	76	—
3% Perp. Prefce.	62	47¼	64½	—

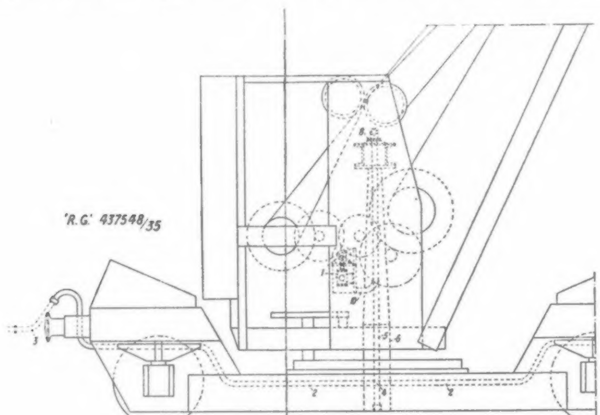
* ex dividend

ABSTRACTS OF RECENT PATENTS*

No. 437,548. Improved Means for Actuating Elevating Devices Associated with Locomotives

Cowans Sheldon and Co. Ltd., and John Barrington Pearson, both of St. Nicholas Works, Carlisle. May 31, 1935.

A means for actuating elevating devices associated with locomotives, *e.g.*, cranes mounted on wagons, consists in the incorporation in an elevating device associated with a locomotive, of a motor deriving its motive power from sub-atmospheric pressure produced in the vacuum brake system of the locomotive. The crane illustrated is equipped with a motor indicated conventionally at 1, deriving its motive power from sub-atmospheric pressure produced in the vacuum brake system of the locomotive and connected to the usual hoisting and associated mechanism. A vacuum pipe line 2 connecting the vacuum brake system of the locomotive is coupled by the standard coupling, *i.e.*, a flexible hose 3; the pipe line 2 is connected at 4 to a pipe 5 co-axial with the centre pin 6 of the crane. A swivel joint 8 connects the pipe 5 with a pipe 10 connected to the air-exhaust branch of the vacuum engine. The motor is of the multiple cylinder type and is

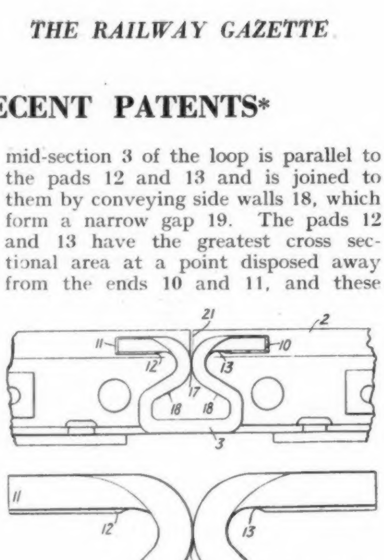


intended to include any vacuum-operated secondary mover, such as a cylinder and a ram.—(*Accepted October* 31, 1935.)

No. 438,642. Improvements relating to Spacing Rail Joints

Ernest Clark Neal, of Coquille, County of Coos, State of Oregon, U.S.A. March 1, 1935.

A one-piece spacing equaliser made of spring material comprises pads 12 and 13 integrally formed at the free ends of a C-shaped resilient loop. The mid-section 3 of the loop is parallel to the pads 12 and 13 and is joined to them by conveying side walls 18, which form a narrow gap 19. The pads 12 and 13 have the greatest cross sectional area at a point disposed away from the ends 10 and 11, and these

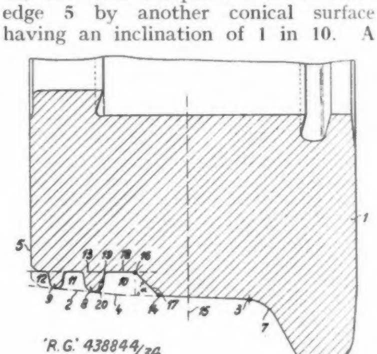


are secured to the rails 1 and 2 by electric or oxy-acetylene welding, the equaliser being subjected to an initial stress whilst being welded to the rails. The intensity of the initial stress is dependent on the conditions prevailing at the time of installation. A weld that will have a greater resistance than the metal itself is provided, so that the device will rupture or break before it is disengaged from the rail to which the respective ends are welded. The device is in the normal position when the rails have the normal gap 21, and the side walls of the resilient loop touch each other at a point 17. In the smaller rail sizes, the device is turned down at right angles adjacent to the gap of the rail, and in the larger sizes, it is constructed so that the intermediate portion is at right angles to the ball of the rail and would extend outwardly therefrom. As the rails tend to contract, the bar will be spaced apart, and as the rails tend to expand or close the gap 21, the side walls 17 will touch at the point 18 and great pressure will be exerted upon the bar to resist the closing of the gap, and to return the gap to the normal when the temperature or other strain is removed. Owing to the welding of the equaliser to the rails, an electric connection is provided, thus doing away with any further bonding or copper fastenings as is customary. The device is constructed so as not to interfere with the usual bolts and nuts used for securing the fishplates or other connecting means employed. — (*Accepted November* 20, 1935.)

No. 438,844. Improvements in Wheels for Railway Vehicles

Gottfried Friedrich Adolf Corts, of 25 V, Berzelügatan, Gothenburg, Sweden. (Convention date: March 27, 1934.)

A wheel for railway vehicles has an upstanding wear-regulating rib formed by providing annular grooves in the tread or tyre of the wheel. The height and width of these ribs decrease progressively as the distance of the rib from the flange of the wheel increases. The tyre 1 has a total width of 135 mm. The tread 2 has a width of 90 mm., and is constituted from the point 3 to the point 4 by a conical surface having an inclination of 1 in 20, and from the point 4 to the outer edge 5 by another conical surface having an inclination of 1 in 10. A



curved surface 7 unites the tread 2 with the flange 6. Between the point 4 and the outer edge 5 of the tyre are provided two wear-regulating ribs 8 and 9. These ribs are formed by three annular grooves 10, 11, 12, provided in the tread surface of the tyre 1. The height and width of the inner rib 8 nearer the flange are greater than the corresponding dimensions of the rib 9 nearer the outer edge 5 of the tyre. The bases of the grooves 10, 11, 12, lie on a cone 13, the radius of which at the point 4 is about 10 mm. smaller, and at the outer edge 5 about 6 mm. smaller than the radius of the original profile of the tread 2 within the same zone. From the point 14 toward the outer edge 5, the tread 2 declines in a straight line at an acute angle down

* These abridgments of recently published specifications are specially compiled for THE RAILWAY GAZETTE by permission of the Controller of His Majesty's Stationery Office. Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2 either sheet by sheet as issued, on payment of a subscription of 5s. a group volume, or in bound volumes, price 2s. each, and the full specifications can be obtained from the same address price 1s, each.

to the point 16. The end of the inclined flank 17 thus formed joins the base 18 of the groove 10. The base has a width of 13 mm. up to point 19, where it merges with a rounded corner into the flank 20 of the first circular rib 8. The total width of the groove 10 thus amounts to about a quarter of the total width of the tread 2. It is essential that the groove 10 should be of sufficient size and that the tread 2 should merge into the groove with an inclined flank, the angle of which may vary and depends on the hardness and elongation of the material of the tyre.

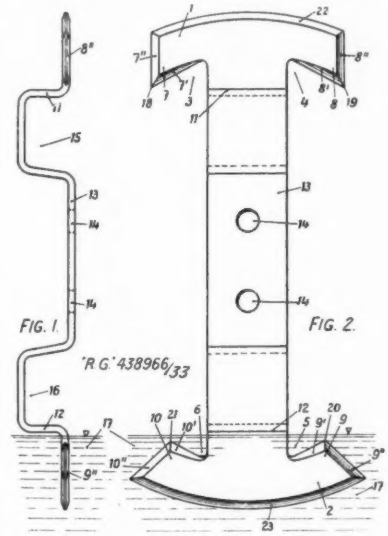
The shape of the ribs 8 and 9 is so chosen that, in so far as they do not lose material by wear, they may compress without filling the grooves 10, 11 and 12 with peeled-off material, and without forming overhanging layers or edges. The cross section of the ribs 8 and 9 is substantially rectangular, the corners being rounded off. The wear of the tread 2 is governed principally by the first rib 8 in connection with the groove 10. The rib 9 situated near the outer edge 5 of the tyre 1 may even be dispensed with.—(*Accepted November* 23, 1935.)

No. 438,966. Oil Feed Rod having Feed-Blades in the Shape of the Segments of a Ring, for Lubricating Axle Bearings

Edward Francis Matthews, of Elm Cottage, Watford Road, Wembley, Middlesex. (*Convention date: July* 17, 1933.)

An oil feed rod is so designed that the distance of the inner edge, 7′, 8′, 9′ and 10′, of each of the two feed blades 1, 2 from the axis of rotation is smaller the greater the distance from the centre of the feed blade. The feed blades are consequently cut back in the direction of rotation at 3, 4, 5 and 6, drip-trips 7, 8, 9 and 10 being formed, and the surface of the feed blade being perpendicular to the rod face 11, 12 supporting the feed blade. The rod support 13 itself, which may be firmly connected by way of holes 14 with the axle journal, possesses at 15 and 16 outwardly arched portions which enable a catching member to be located within range of the drippings and treads formed by the feed-member. As will be noticed from the lower parts of Figs. 1 and 2, the whole of the feed blades 1 and 2, together with the drip-trips 7 and 8, can be dipped into the lubricant store 17 without the parts 11 and 12 requiring to dip into the lubricant. Nevertheless, fully developed drip trips are formed, which cause the lubricant to drip off with certainty. The lubricant store is consequently traversed only by the feed blades, without it being possible for the lubricant to be lashed up injuriously, emulsified and oxidised. The bounding edges 7′, 7″, 8′, 8″, 9′, 9″ and 10′, 10″, which form the drip-trips, possess different lengths on the different feed blades. The result of this is that the mutual action between gravity, forces of adhesion, forces of cohesion, and centrifugal forces take place differently on the two feed blades, so that one blade always effects dripping with certainty when the dripping on the other blade has stopped due to conditions of equilibrium in the forces.

The feed blades are constructed as annular figures which differ from one another as regards the positions of the corner points, so that in particular the points 18, 19 of the feed blade 1 giving rise to the formation of threads is different from the position of the points 20, 21 in the case of the other feed-blade, the threads formed by the feed blades do not mutually disturb one another. The bounding edges 22, 23 of the feed blades 1 and 2, which act centrifugally, are of different lengths, so that the resultant forces which lead

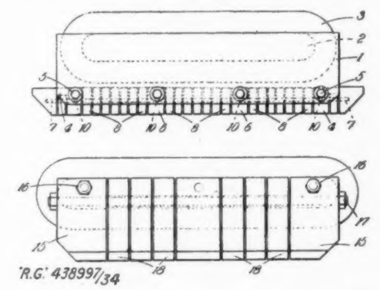


to the centrifuging of the lubricant arise in the case of the two feed blades in such a different way that one blade throws off the lubricant before the other. The blades are constructed as narrow segments of a ring, so that the paths along which the lubricant slips, measured in the radial direction, are shorter than the paths along which it is drawn, measured in the peripheral direction. The edges 7′, 7″, 8′, 8″, 9′, 9″, 10′, 10″, 22 and 23 are formed as knife edges in order to prevent air from being driven into the lubricant store.—(*Accepted November* 25, 1935.)

No. 438,997. Improvements relating to Electromagnetic Track Brakes

Knorr-Bremse A.G., of 9-17, *Neue Balmofstrasse, Lichtenberg, Berlin, Germany.* (*Convention date: November* 12, 1934.)

In an electromagnetic track brake the pole pieces or the entire magnet body are transversely sub-divided into individual block-like sections which are arranged so that they can be displaced relatively to each other in the vertical plane so as to adopt themselves to the unevenness of the upper surface of the rail. The sections or blocks 4 projecting at the ends beyond the cheeks 1 of the electromagnets are secured by screws 5 to the cheeks, which are connected together by the core 2 and form a structural unit with the core over their entire length. Further pole-piece blocks 6 screwed to the side parts 2 are distributed over the length of the magnet. In each of the blocks 4 and 6 is mounted a steel wire 7 on which the remaining pole-piece blocks 8 not screwed to the magnet are loosely strung. Sheets of brass extending from one terminal pole-piece block to the other are secured to the inner sides of the screwed-on pole-piece blocks 4 and 6 by screws 10. The sheets serve chiefly to prevent the pole-piece blocks from sliding off the wires 7 during the transport of the parts before being secured by the screws 5, but also to prevent immediate contact of opposite pole-pieces. The exciting coil 3 is wound



about the core 2 connecting the side parts 1. Instead of dividing the pole shoes, the entire magnet body may be sub-divided transversely into sections or blocks. The sections 15 situated at the ends are held together by screws 16. Elastic steel wires or rods 17 extend through them in the longitudinal direction, on which the blocks 18 are strung. The blocks 18 have holes the diameters of which are slightly larger than that of the rod 17 to allow of a slight vertical displacement within limits.—(*Accepted November* 17, 1935.)

COMPLETE SPECIFICATIONS ACCEPTED

438,650. Spencer, A., and Spencer, Moulton & Co. Ltd., G. Pinching apparatus for railway vehicles and the like.

438,761. Main, D. W. Vehicles for alternative rail or road use.

438,930. Barry, P. Stuffing-box packings.

439,326. Bugatti, E. Coupling apparatus for vehicles and especially for railway vehicles.

439,333. Huguenin, A. Set of loose wheels for railway vehicles.

439,911. Franklin Railway Supply Company. Means for cushioning motion of a railway-vehicle axle.

440,048. General Railway Signal Company. Remote-control of railway-track switches and signals.

440,078. Westinghouse Brake & Saxby Signal Co. Ltd. Fluid-pressure braking-apparatus for rail and other vehicles.

440,435. Harrison, H. H. Magnetic devices for use in train control or railway signalling systems.

CONTRACTS AND TENDERS

Articulated Locomotives for Siam

Henschel & Sohn A.G. has received an order for two Garratt articulated locomotives having the 2-8-2 + 2-8-2 wheel arrangement to be supplied to the inspection of Messrs. Sandberg for the Siamese State Railways.

Coaches for Palestine

The Gloucester Railway Carriage & Wagon Co. Ltd. has received an order from the Crown Agents for the Colonies for six bogie third-class passenger coaches for the Palestine Railways.

Samuel Fox & Co. Ltd. has received an order from the Assam-Bengal Railway for 30 tons of spring steel flat bars.

Beyer, Peacock & Co. Ltd. has received an order for two locomotive boilers for the Central Uruguay Railway of Monte Video.

Richards Limited has received an order from the Madras & Southern Mahratta Railway for 10,000 ft. of canvas water delivery hose.

Leyland Motors Limited has received the following orders from railway and railway-associated road transport operators :—

Londonderry & Lough Swilly Railway, one Lion passenger vehicle.

South African Railways & Harbours Board, seven Terriers and two Beaver-Six goods vehicles.

The Rohilkund & Kumaon Railway Administration has placed the following orders to the inspection of Messrs. Rendel, Palmer & Tritton :—

Steel, Peech & Tozer Limited, 100 carriage and wagon tyres and a number of carriage and wagon axles.

North British Locomotive Co. Ltd., Nasmyth, Wilson & Co. Ltd., and the Yorkshire Engine Co. Ltd., duplicate parts for locomotives.

The Bengal North Western Railway Administration has placed the following orders to the inspection of Messrs. Rendel, Palmer & Tritton :—

Vulcan Foundry Limited, 60 locomotive ax'es, eight sets of piston valve liners, four engine sets of piston valves.

North British Locomotive Co. Ltd., 48 locomotive valve spindles.

John Spencer & Sons Ltd., 96 locomotive and four carriage axles.

Consolidated Brake & Engineering Co. Ltd., indiarubber parts for vacuum brake gear.

Usines Acieries Allard, 250 cast-steel carriage and wagon axleboxes.

J. Baker & Bessemer Limited, 175 locomotive tyres.

Fried. Krupp A.G., helical and volute springs.

Bochumer Verein A.G., volute springs.

The Bombay, Baroda & Central India Railway Administration has placed the following orders to the inspection of Messrs. Rendel, Palmer & Tritton :—

Ferodo Limited, 1,120 Ferodo liners and wearing plates for electric stock.

Miller & Co. Ltd., 300 chilled cast-iron wheels.

Steel, Peech & Tozer Limited, 100 locomotive tyres.

Stewarts and Lloyds Limited, 150 steel boiler tubes.

North British Locomotive Co. Ltd., locomotive details.

Skoda Works (through Carters Merchants Limited), 800 carriage and wagon tyres.

John Spencer & Sons Ltd., 200 carriage and wagon axles.

The Bambairtite Battery Co. Ltd. has received an order from the South Indian Railway for 2,000 Bambairtite patent Léclanche cells, No. 1 type.

Whitelegg & Rogers has received an order from the Chinese Government Purchasing Commission, to the inspection of Messrs. Sandberg, for 16 sets of internal parts for Ajax patent grease lubricators, required for Canton-Hankow Railway locomotives.

The Austrian Federal Railways Administration has ordered six two cylinder 2-8-4 express and six 4-6-4 passenger tank locomotives from the Wiener Lokomotivfabrik, Floridsdorf. The express engines are to be partly streamlined.

The Egyptian State Railways Administration has placed the following orders :—

Nye & Menzies Limited, bolts and nuts (ref. E.S.R. 3.207, total price £242 f.o.b. Antwerp).

Haine St. Pierre, boilers (ref. E.S.R. 21.414, item 1, total price £2,090, f.o.b. Antwerp.)

Robt. Stephenson & Co. Ltd., boilers (ref. E.S.R. 21.414, item 2, total price £2,340, f.o.b. Middlesborough).

The Drewry Car Co. Ltd. has received an order from the Crown Agents for the Colonies for one 24-h.p. semi-enclosed inspection railcar and two inspection trolleys. These vehicles are required for service in the Federated Malay States and follow orders for similar vehicles already in service.

Brayshaw Furnaces & Tools Limited is completing a contract from the Madras & Southern Mahratta Railway for the supply of a large oil-fired oven furnace required for the accurate heat treatment of connecting rods and links, &c. The furnace is built to the specification and inspection of Messrs. Rendel, Palmer & Tritton and the principal features include a " 100 per cent. air " oil burner, door operated by capstan wheel, automatic oil cut-out in case of failure of the air supply, and automatic temperature control equipment. The same firm has recently completed a contract for the supply of 13 white-metal melting pot furnaces for a leading British railway.

D. Wickham & Co. Ltd. has received an order from the Central Argentine Railway for two mechanic's railcars and spare axleboxes and from the Great Western of Brazil Railway for two 10-h.p. inspection railcars.

The Bengal-Nagpur Railway Administration has placed the following orders :—

Wm. Asquith Limited, locomotive tyre drilling machine.

Noble & Lund Limited, two wheel lathes.

Churchill Machine Tool Co. Ltd., axle journal regrinding machine.

Butler Machine Tool Co. Ltd., spur gear planing machine.

J. Bennie & Sons Limited, plate shearing machine.

Fielding & Platt Limited, hydraulic wheel press.

The L.M.S.R. is to instal a 70-ft. turntable at London Road station, Manchester, for turning locomotives of " The Princess Royal " class. The scheme will involve a slight widening of the viaduct and the pathway at Fairfield Street.

The Great Western Railway has placed the following orders :

H. Fairweather & Co. Ltd., extensions to electrical workshop at Paddington.

Standard Telephones & Cables Limited, installation of automatic telephone exchange at Reading.

C. Isler & Co. Ltd. and Le Grand Sutcliffe & Gell Limited, sinking of bore holes in connection with new railways between St. Germans and Looe and near Teignmouth.

H. W. Ward & Co. Ltd., three turret lathes for Swindon shops.

Dowding & Doll Limited, two Pittler turret lathes for Swindon shops.

C. Churchill & Co. Ltd., vertical milling machine for Swindon shops.

D. Etchell & Son Limited, nut making machine for Swindon shops.

H. Morris Limited, 10-cwt. electric hoist block for Swindon shops.

Mercury Truck & Tractor Co. Ltd., two general purpose tractors.

Chesterfield Tube Co. Ltd., spare potash charging battery for oxygen production plant for Swindon shops.

A. Herbert Limited, horizontal milling machine for Swindon shops.

Bookings of the Baldwin Locomotive Works during February amounted to $3,600,000, against $1,596,000 in February, 1934, states a Reuters message.

The Jugoslav Parliament has passed a finance Bill authorising the Minister for Transport to take up a home or foreign loan of 300,000,000 dinars (£920,000) for the renewal of the rolling stock of the Jugoslav State Railways, states the Vienna Correspondent of *The Times*.

Boilers Required for India

The Controller of Stores, North Western Railway, Lahore, is calling for tenders, to be presented in Lahore, by April 28, for the supply of 30 superheated locomotive boilers for SP/S. (4-4-0) class standard engines. Further particulars may be obtained by firms desirous of offering boilers of United Kingdom manufacture from the Department of Overseas Trade.

The Egyptian State Railways Administration is calling for tenders receivable on the dates given, as follow : Machine tools (April 16), rivets (April 14) bolts and nuts (April 4), coal (May 5), tyres for bogie wagons (April 28), copper wire (April 21), oil (March 25), and, on dates not specified, for glass and slide bars. Further details can be obtained from the Egyptian State Railways Administration at Cairo, or from the Chief Inspecting Engineer, 41, Tothill Street, London, S.W.1.

Bruce Peebles & Co. Ltd., Edinburgh, has moved its Manchester offices to a more central position, at 2, Exchange Street, Manchester, 2 (telephone, Blackfriars 1355). Mr. H. V. Balm is in charge of the Manchester offices.

PARLIAMENTARY AND OFFICIAL NOTICES

In Parliament.—Session 1935-36.

London and North Eastern Railway (General Powers)

ADDITIONAL PROVISION.

NOTICE has been given in *The Times* newspaper of the 16th and 23rd March, 1936, that application is to be made to Parliament in the present Session by the London & North Eastern Railway Company (hereinafter referred to as "the Company") by Petition for Additional Provision for leave to introduce into the Bill now pending in Parliament under the above name or short title a provision for purposes of which the following is a concise summary:—

Power to Minister of Transport to provide by order that such of the provisions of the Roads Act, 1920, the Road and Rail Traffic Act, 1933, and the Road Traffic Acts, 1930 to 1934, or any regulations made thereunder as are in his opinion inappropriate shall not apply to any motor vehicles or trailers which the Company may use over and along that part of Nelson Street in the City and County of Kingston upon Hull which lies between Pier Street and Queen Street for transporting goods and merchandise between the Victoria Pier and the Company's premises on the north side of Nelson Street.

The exact terms of the Additional Provision can be seen and copies of it obtained at a price not exceeding 6d. per copy at the under-mentioned offices.

I. BUCHANAN PRITCHARD,
King's Cross Station, N.1.
Chief Legal Adviser.
H. R. CRIPPS,
4, Cowley Street,
Westminster, S.W.1.
Chief Assistant Solicitor.
SHERWOOD & Co.,
22, Abingdon Street,
Westminster, S.W.1.
Parliamentary Agents.

THE Owner of British Patent No. 389,737, relating to "Improvement in or relating to Braking Apparatus for Railmotorcars," is desirous of entering into negotiations for the grant of licences thereunder on reasonable terms. For particulars address c/o F. W. LE TALL, Number One Kingsway, London, W.C.2.

PATENTS for Inventions, Trade Marks, Advice, Handbook, and consultations free. King's Patent Agency, Ltd. (B. T. King, C.I.M.E., Registered Patent Agent, G.B., U.S., and Canada), 146A, Queen Victoria Street, London, E.C.4. 50 years' references. 'Phone City 6161.

London & North Eastern Railway Company

NOTICE IS HEREBY GIVEN that, for the purpose of preparing the warrants for Interest payable on the 15th April, 1936, on the Company's 5 per cent. Redeemable Debenture Stock, the balance will be struck as at the close of business on 27th March, and such Interest will be payable only to those Stockholders whose names are registered on that date.

Transfers of the 5 per cent. Redeemable Debenture Stock should, therefore, be lodged with the Registrar of the Company at Hamilton Buildings, Liverpool Street Station, London, E.C.2, before 5 p.m. on 27th March.

By Order,
JAMES McLAREN,
Secretary.

Marylebone Station,
London, N.W.1.
17th March, 1936.

Railway Materials & Equipment Manufacturers

ADVERTISER desires active Directorship in an established concern, Birmingham or London Districts. Previous works and selling experience among Home and Foreign Railways. Good connection rolling stock builders, &c. Could probably introduce a strong Sales Organisation if required. Age 45. Audited accounts essential. Capital available, £10,000. Please communicate with DOCKER, HOSGOOD & Co., 10, Newhall Street, Birmingham, in first instance.

Railway and Other Reports

British Aluminium Co. Ltd.—The profit for 1935, including the amount brought forward, after making provision for taxation, and for interest upon debenture stocks, and after setting aside £50,000 to depreciation reserve, is £302,227. This compares with £222,970 for 1934. The directors recommend a dividend of 7½ per cent. for the year on the ordinary share capital, leaving £62,227 to be carried forward.

North British Locomotive Co. Ltd.—For the year 1935 there was a loss of £86,007, comparing with a loss of £34,656 for 1934. Conditions in the industry were again most unsatisfactory, and such contracts as were available left little hope of remunerative return. Towards the close of the year, however, substantial contracts in which the company shared were placed by the home railways, but these did not affect the operations of the period. It is proposed to convert the ordinary and preference shares into ordinary stock and preference stock respectively.

Railway Finance Corporation.—The statutory report states that no shares have been allotted; 100 shares of £1, being whole of authorised share capital, were subscribed upon memorandum of association on the basis that they were payable in cash. Receipts and payments made to February 24 were: Receipts in respect of shares £100, in respect of issue of £27,000,000 debenture stock £5,535,000, bank interest £81, total £5,535,081. Payments: Preliminary expenses (expenses in connection with issue of debenture stock) £28,544, bank deposits £4,500,000, purchase of Treasury bills £998,750, balance at February 24 £7,887, total £5,535,181. Preliminary expenses are estimated at £65,730 (including the sum of £28,544 shown above). Under the terms of agreement dated January 23, 1936, the parties therein referred to as "railway companies" agree to bear all such expenses.

Dublin United Tramways Co. (1896) Ltd.—Net revenue for the year 1935 amounted to £57,644 compared with £100,050 for 1934. Owing to the suspension of services for 76 days on account of withdrawal of labour, the balance after payment of the preference dividend and the allocation of £20,000 to debenture redemption does not permit of any dividend on the ordinary stock. The amount carried forward is £9,744, against £17,127 brought in. For 1934 the ordinary dividend was 3 per cent., £20,000 was appropriated to debenture redemption and £20,000 was set aside towards renewal of permanent way.

Hoffmann Manufacturing Co. Ltd.—This company, which is controlled by Brown Bayley's Steel Works Limited, reports a profit of £142,159 for 1935, after allowing for income from investments and deducting charges for income tax, depreciation, &c. The net profit, after meeting debenture interest, directors' fees, &c., is £127,552, against £85,944 for 1934. As already announced, a total distribution of 15 per cent., tax free, is being made on the ordinary shares. The directors also propose to provide £35,000 for pensions, and to transfer £20,000 (against £10,000) to general reserve, leaving £67,149 to be carried forward, as against £69,597 brought in.

Forthcoming Events

Mar. 20-23.—Institution of Mechanical Engineers (Graduate). Annual Week-End.

Mar. 21 (*Sat.*).—L.N.E.R. (G.C.) Debating Society, at University College, Shakespeare Street, Nottingham, 4.30 p.m. "Organisation and Working of Manchester L.N.E.R. and C.L.C. Goods Depots," by Mr. F. Batchelor.

Permanent Way Institution (London), at Inst. of Civil Engineers, Great George Street, S.W.1, 2.30 p.m. Annual Winter Meeting. Dinner at Maison Lyons, Shaftesbury Avenue, W.1, 6.30 p.m.

Mar. 24 (*Tues.*).—Great Eastern A.A.A., at Stadium Club, 85, High Holborn, London, W.C.1, 6.45 p.m. Boxing Championships.

Institute of Transport (Birmingham Graduate), at Imperial Hotel, 6.30 p.m. "Industrial Transport," by Mr. D. Jones.

Institution of Civil Engineers, Great George Street, London, S.W.1, 6 p.m. "The Superstructure of the Island of Orleans Suspension Bridge, Quebec, Canada," by Mr. S. Banks.

L.N.E.R. (York) Lecture and Debating Society, at Railway Inst., Queen Street, 7 p.m. Annual General Meeting and Reading of Prize Essays.

Permanent Way Institution (Scottish), at Royal Technical College, George Street, Glasgow, 7.15 p.m. "Simple Permanent Way Calculations," by Mr. M. Frieze.

Mar. 25 (*Wed.*)—Institution of Civil Engineers (Students), Great George Street, London, S.W.1, 6.30 p.m. "Installation of Escalators and Reconstruction at Moorgate Station," by Mr. D. Thomas.

Mar. 26 (*Thurs.*).—Institution of Locomotive Engineers (London), at Inst. of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. "Superheating," by Mr. H. Geer.

Railway Convalescent Homes, at Hotel Great Central, Marylebone, London, N.W.1, 6.15 for 6.45 p.m. Banquet.

Mar. 27 (*Fri.*).—G.W.R., at Queen's Hall, Langham Place, London, W.1, 7.45 p.m. Smoking Concert.

Institution of Structural Engineers (Midland), at James Watt Memorial Inst., Birmingham, 6 p.m. "The Effect of the Coarse Aggregate and Other Factors on the Properties of Concrete," by Mr. H. Coultas.

L.N.E.R. (London) Musical Society, at Hamilton Hall, Liverpool Street, E.C.2, 8 p.m. Bohemian Concert.

Railway Share Market

The stock and share markets showed a partial recovery this week from their recent sharp reaction. This was primarily attributed to the rather more hopeful developments in the European political situation, but the numerous reports issued by industrial companies showing increased profits and dividends and the favourable news which continues to come to hand from trade centres were also factors which affected sentiment.

Expectations that the heavy industries are likely to remain active for some time to come and the belief that internal trade conditions are at least being maintained were among the points which attracted more attention to Home railway stocks. L.M.S. issues were favoured on the traffic increase of £24,000 which brings the total increase of the line so far this year up to £350,000. The ordinary stock was in request partly on calculations current in the market that if for the rest of the year there is an average increase in traffics of about £30,000 weekly, fully 1 per cent. will be earned on the stock. The 1923 preference was good, buyers being attracted by the favourable yield offered and the 4 per cent. preference also moved in favour of holders. The 4 per cent debentures were higher at 106½. "Berwick" first and second preference participated in the improved tendency and higher prices were also made by the 3 per cent. and 4 per cent. debentures. Southern preferred and deferred were firmer, partly on the news that work is commencing on the electrification of the line from London to Portsmouth Harbour. Great Western ordinary improved and the 5 per cent. preference gained half a point to 119½. London Transport "C" was in request.

There was a brighter tone in the foreign railway market where the chief feature was another outburst of activity in Cordoba Central debentures. B.A.G.S., B.A. Western, B.A. Pacific and Central Argentine all established fractional gains, Antofagasta were more than a point better. San Paulo reacted rather sharply on varying estimates as to the final dividend announcement, due next month. Canadian Pacific ordinary and preference showed some recovery, and among Americans Northern Pacific and Southern Pacific moved to higher prices.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1935-36	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1935	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1935	Prices: Lowest 1935	Prices: Mar 18., 1936	Prices: Yield (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili)&Bolivia	834	15.3.36	13,910	+ 2,160	11	152,350	134,080	+ 18,270	Ord. Stk.	23	14 15/16	23 1/2	Nil
	Argentine North Eastern	753	14.3.36	8,208	+ 958	37	288,468	267,575	+ 20,893	"	7	4	5	Nil
	Argentine Transandine	—	—	—	—	—	—	—	—	A. Deb.	49 1/2	30	50	8
	Bolivar	174	Feb., 1936	6,650	+ 50	9	12,150	12,450	− 300	6 p.c. Deb.	13	5	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	14	11	14	3 9/16
	Buenos Ayres & Pacific	2,806	14.3.36	105,229	+ 6,648	37	3,003,273	2,734,260	+ 269,013	Ord. Stk.	10 1/2	4 7/8	8 1/2	Nil
	Buenos Ayres Central	190	29.2.36	$81,600	− $20,500	35	$4,015,400	$3,934,400	+ $81,000	Mt. Deb.	21	10	15 1/2	Nil
	Buenos Ayres Gt. Southern	5,084	14.3.36	155,640	− 23,662	37	4,816,960	5,266,658	− 449,698	Ord. Stk.	27	13 1/2	19	Nil
	Buenos Ayres Western	1,930	14.3.36	51,528	− 1,695	37	1,637,746	1,623,412	+ 14,334	"	24	10	15	Nil
	Central Argentine	3,700	14.3.36	119,747	− 2,134	37	4,479,717	4,360,856	+ 118,861	"	17 7/8	7	12	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	9	3 1/4	6 1/2	Nil
	Cent. Uruguay of M. Video	273	7.3.36	13,413	+ 2,948	36	386,656	520,171	− 133,515	Ord. Stk.	8 1/2	3	7	Nil
	Do. Eastern Extn.	311	7.3.36	2,600	+ 482	36	71,716	68,359	+ 3,357	—	—	—	—	—
	Do. Northern Extn.	185	7.3.36	1,624	+ 514	36	50,259	37,101	+ 13,158	—	—	—	—	—
	Do. Western Extn.	211	7.3.36	1,055	+ 407	36	31,753	28,819	+ 2,934	—	—	—	—	—
	Cordoba Central	1,218	14.3.36	24,210	+ 500	37	1,059,000	1,057,440	+ 1,560	Ord. Inc.	4	1	2 1/2	Nil
	Costa Rica	188	Dec., 1935	12,022	− 6,024	26	80,721	99,051	− 18,330	Stk.	35	30	35	5 11/16
	Dorada	70	Feb., 1936	12,300	+ 1,300	9	25,600	21,500	+ 4,100	1 Mt. Db.	103 5/8	102 1/2	104 1/2	5 3/4
	Entre Rios	810	14.3.36	9,489	− 1,960	37	408,247	463,058	− 54,811	Ord. Stk.	15	6 1/2	10	Nil
	Great Western of Brazil	1,082	14.3.36	9,600	+ 900	11	108,500	118,700	− 10,200	Ord. Sh.	1/2	5/16	1/2	Nil
	International of Cl. Amer.	794	Jan., 1936	$501,540	+ $72,063	5	$501,540	$429,477	+ $72,063	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	1/2	3/32	1/2	Nil
	La Guaira & Caracas	22 3/4	Feb., 1936	4,225	+ 825	9	8,650	6,500	+ 2,150	Stk.	8 1/2	8	8 1/2	Nil
	Leopoldina	1,918	14.3.36	17,847	− 2,027	11	198,374	190,758	+ 7,616	Ord. Stk.	8 1/2	2 1/2	7	Nil
	Mexican	483	14.3.36	$246,700	+ $25,800	11	$2,654,400	$2,443,500	+ $210,900	"	1 1/2	1/4	1	Nil
	Midland of Uruguay	319	Feb., 1936	8,176	+ 2,203	35	56,312	85,088	− 28,776	"	1 1/2	1 1/2	1 1/2	Nil
	Nitrate	401	15.3.36	6,615	+ 2,469	11	35,969	30,491	+ 5,478	Ord. Sh.	64/-	42/-	2 1/2	Nil
	Paraguay Central	274	7.3.36	$2,349,000	+ $1,129,000	36	$74,755,000	$37,598,000	+ $37,157,000	Pr. Li. Stk.	80 1/2	60	77	7 13/16
	Peruvian Corporation	1,059	Feb., 1936	78,640	+ 15,819	35	616,056	499,646	+ 116,410	Pref.	10 5/8	6 7/16	13 1/2	Nil
	Salvador	100	7.3.36	¢27,600	− ¢4,600	36	¢669,196	¢689,302	− ¢20,106	Pr. Li.Db.	65	61	65	7 11/16
	San Paulo	153 1/2	8.3.36	25,802	+ 4,652	10	257,858	214,303	+ 43,555	Ord. Stk.	80	35	57 1/2	4 5/16
	Taltal	164	Feb., 1936	4,570	− 695	35	28,485	22,707	+ 5,778	Ord. Sh.	1 11/16	1 1/8	1 1/8	7 1/4
	United of Havana	1,353	14.3.36	50,081	+ 6,496	37	786,429	817,999	− 31,570	Ord. Stk.	3 1/16	1	3	Nil
	Uruguay Northern	73	Feb., 1936	807	+ 246	35	6,367	9,007	− 2,640	Deb. Stk.	4 1/2	2 15/16	4 1/2	Nil
Canada.	Canadian National	23,684	7.3.36	660,804	+ 38,215	10	5,822,616	5,529,413	+ 293,203	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	—	4 p.c. Perp. Dbs.	78 3/8	52 1/2	69	5 13/16
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	103 5/8	93	103 1/2	3 7/8
	Canadian Pacific	17,260	7.3.36	482,600	+ 34,200	10	4,203,400	3,833,000	+ 370,400	Ord. Stk.	14 1/16	8 3/4	13 1/2	Nil
India.†	Assam Bengal	1,329	29.2.36	37,845	− 5,008	46	1,125,033	1,276,518	− 151,485	Ord. Stk.	92 1/8	77 1/2	85 1/2	3 1/2
	Barsi Light	202	29.2.36	3,435	+ 83	46	127,515	124,845	+ 2,670	Ord. Sh.	105	77 1/2	73 1/2	6 15/16
	Bengal & North Western	2,112	29.2.36	81,451	+ 3,043	48	1,142,478	1,134,039	+ 8,439	Ord. Stk.	301 1/2	291	304 1/2	5 1/4
	Bengal Dooars & Extension	161	29.2.36	3,733	− 313	46	125,349	141,219	− 15,870	"	127 1/2	122	122 1/2	5 11/16
	Bengal-Nagpur	3,268	10.2.36	175,575	− 19,327	45	5,496,754	5,117,688	+ 379,066	"	105	100 5/16	102 1/2	3 7/8
	Bombay, Baroda & Cl. India	3,072	10.3.36	274,125	+ 14,775	49	7,802,475	7,828,950	− 26,475	"	115 1/4	110	112 1/2	5 5/16
	Madras & Southern Mahratta	3,230	29.2.36	156,600	− 2,057	46	4,759,146	4,958,035	− 198,889	"	128 1/2	113 7/8	115 1/2	7 3/4
	Rohilkund & Kumaon	572	29.2.36	16,818	+ 464	48	224,589	225,137	− 548	"	294	262	300 1/2	5 5/16
	South India	2,526	29.2.36	102,113	− 16,543	46	3,491,106	3,695,204	− 204,098	"	119 3/4	104 1/4	106 1/2	7 1/16
Various.	Beira-Umtali	204	Jan., 1936	61,199	− 3,320	17	254,392	245,504	+ 8,888	—	—	—	—	—
	Bilbao River & Cantabrian	15	Feb., 1936	2,152	+ 91	9	3,469	4,310	− 841	—	—	—	—	—
	Egyptian Delta	622	29.2.36	5,550	+ 370	48	231,895	222,142	+ 9,753	Prf. Sh.	2	1 5/8	1 3/4	5 11/16
	Great Southern of Spain	104	7.3.36	859	− 469	10	11,801	18,831	− 7,030	Inc. Deb.	3 1/2	2	3 1/2	Nil
	Kenya & Uganda	1,625	Nov., 1935	182,196	+ 11,855	48	2,184,339	2,030,213	+ 154,126	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	48	36	47 1/2	7 7/8
	Mashonaland	913	Jan., 1936	97,871	− 23,922	17	410,904	464,048	− 53,144	1 Mg. Db.	104 1/4	100	104 1/2	4 3/4
	Midland of W. Australia	277	Jan., 1936	14,828	+ 1,651	31	98,451	99,125	− 674	Inc. Deb.	98 3/4	93	94 1/2	5 5/16
	Nigerian	1,905	25.1.36	59,667	+ 65	43	1,528,569	1,624,128	− 95,559	—	—	—	—	—
	Rhodesia	1,538	Jan., 1936	180,459	− 15,308	17	756,445	752,419	+ 4,026	4 p.c. Db.	105 1/2	101	105	3 15/16
	South African	13,246	22.2.36	581,401	+ 69,043	47	26,869,040	24,250,525	+ 2,618,515	—	—	—	—	—
	Victoria	4,728	Nov., 1935	823,035	− 25,801	21	3,959,297	3,881,659	+ 77,638	—	—	—	—	—
	Zafra & Huelva	112	Jan., 1936	10,488	− 895	5	10,488	11,383	− 895	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency.

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the Sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rates of exchange and not on the par value

Diesel Railway Traction

The Diesel Question in Iraq

FIFTEEN months ago we suggested diesel railcars might be found in future on the reputed site of the Garden of Eden, and if one substitutes the word "locomotive" for our "railcar," it would appear that the prophecy has gone a step nearer its fulfilment. In his report for the year ending March 31, 1935, which has just been issued, the Director of Railways to the Iraq Government says the necessity for the acquisition of diesel engines becomes more and more urgent with the passage of time, and it is considered that units of about 400 h.p. would provide the service required. Single units of this size could operate passenger trains and double units could operate heavy goods trains. But the Director states that, from the financial point of view, it would not be justifiable to embark on the acquisition of the considerable number of diesels required without the assurance of successful experience elsewhere. This is curious in view of the success of diesel locomotives, of the very size required in Iraq, in Denmark, Siam, Austria and elsewhere. Although the Director's report recognises that diesel traction is more economical than steam, the vast riches of Iraq in the form of almost illimitable oil fields do not allow money to be spent on that motive power for the government railways which is not only most efficient but would use the country's own fuel.

The New British Diesel Shunters

IT is possible that the 20 oil-electric shunting locomotives now being delivered to the L.M.S.R. may form the beginning of an extensive vogue for such units in this country, and it may be that very few steam shunting engines will be built in future for use on the lines of the four British main line companies. At the time the order was placed it was deemed that insufficient experience had been gained with mechanical transmission to warrant its extension from the 150-180 b.h.p. units then at work on the L.M.S.R. to the heavier and more powerful locomotives then required. Further, to give maximum, as against general, satisfaction, it was felt that whatever oil engine was used it should be of a type that had already given reliable service in railway work. Designs compatible with both of these desiderata were to hand in the English Electric and Armstrong-Whitworth products. The 300 b.h.p. demonstration unit of the English Electric Company, set to work in 1934, had given generally satisfactory results, and the 250 b.h.p. Armstrong-Whitworth shunting locomotive, purchased by the L.M.S.R. in the same year, was doing good work. Actually, this machine has worked in Brent sidings for nearly two years without any engine failure being recorded. The English Electric demonstration locomotive has now been bought by the L.M.S.R., and is at Crewe works being overhauled and modified to bring it into line with the ten new locomotives of the same make. During its period of service, the maintenance charges per hour have amounted to about 13½d., of which 5¼d. were due to the engine and auxiliaries, 4½d. to the transmission, and 3¾d. to the mechanical portion. These figures do not include the cost of the general overhaul now being carried out. The operating and maintenance cost (exclusive of capital charges) has averaged about 41d. per hour. The maximum designed speed of the 20 new locomotives has been limited to 22 m.p.h. and the maximum tractive effort of 30,000 lb. (giving a factor of adhesion of 3·75), can be maintained up to about 2½ m.p.h. At 20 m.p.h. the tractive effort of the English Electric design is 4,700 lb. and of the Armstrong-Whitworth locomotives, 3,000 lb. Numerous details on the two makes are common, including the big shunters' footstep at the leading end, and the electric food cooker in the cab, which boils the proverbial egg and warms the proverbial can. Porterhouse steaks do not come within the capacity of this innovation, so apparently the slight physical effort required to operate oil-electric locomotives has led to a growing appreciation of vegetarianism by the drivers.

A Treatise on Railcars

UNDER the chairmanship of Sir Arnold Wilson, M.P., a symposium on railcars was read and discussed at the Royal Geographical Society's Hall, Kensington, on March 3. Organised by the Institution of Automobile Engineers, the occasion was a joint meeting of nine technical societies, including the Diesel Engine Users' Association, the Institution of Locomotive Engineers, the Iron and Steel Institute, and the Institute of Fuel. The first paper, dealing with engines, was presented by Mr. H. D. Bush, of Wm. Beardmore & Co. Ltd.; the second, on mechanical transmissions, by Major W. G. Wilson, of the Self-Changing Gear Trading Co. Ltd.; the third, on the chassis and body, by Mr. C. J. H. Trutch, of Sir W. G. Armstrong Whitworth & Co. (Engineers) Ltd.; and the fourth, on operation, by Mr. Julian Tritton, of Messrs. Rendel, Palmer & Tritton.

Much useful information was contained in these four papers, but considered as a symposium on railcars there was a notable lack of balance in the first two papers, which was occasioned by the authors considering only their own experience, and neglecting almost entirely the hundreds of successful railcars, engines, and transmissions embodying other products than their own. The third paper was balanced, although restricted, as regards the text, but the numerous slides shown mostly related to the cars made by one firm. As a result, the members of at least five of the participating societies must have a curious idea of the position of oil-engine traction on railways, for in the normal way they are concerned merely with one phase or another of the subject and were expecting to obtain a clear and truthful idea of what had been done. One of the reasons for the co-operation of all these institutions was for the dissemination of information likely to be of value to automobile firms who are engaged in or taking up the manufacture of railcars, and in this respect the papers had a somewhat greater value, although still suffering severely from the narrow angle of approach. An exception may be made in the case of Mr. Tritton's effort, for he viewed the railway side of the question very broadly in an attempt to clarify the requirements and possibilities of railcars. Brief abstracts from each of the four papers are given elsewhere in this issue.

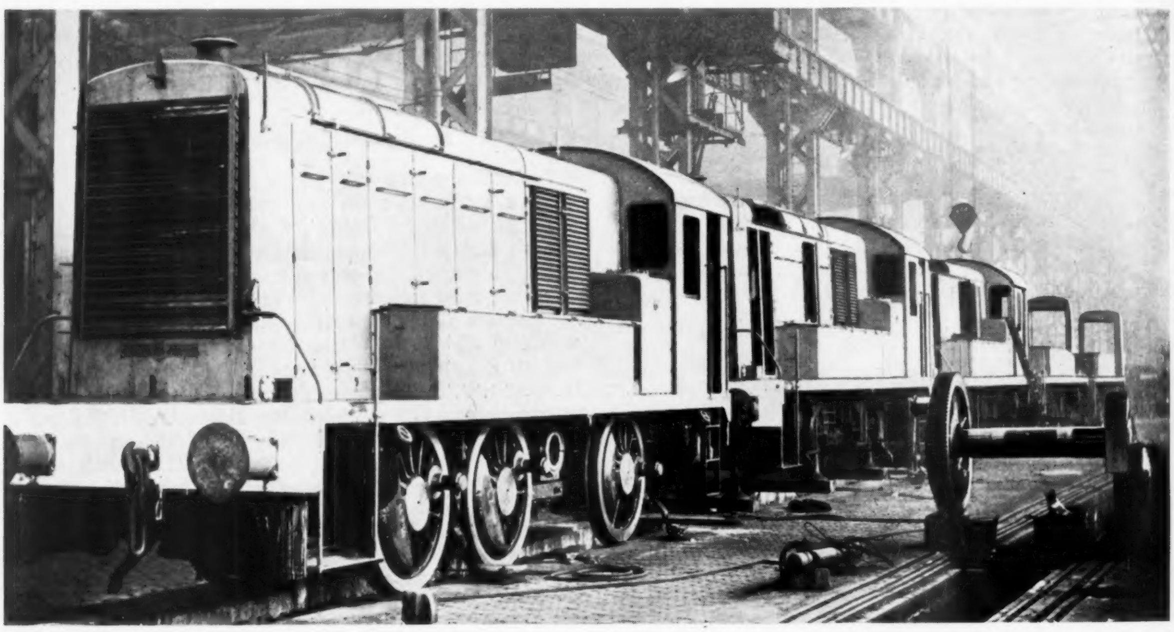
ARMSTRONG-WHITWORTH LOCOMOTIVES FOR L.M.S.R.

New design is a development of the successful 250 b.h.p. shunter

The design of the ten Armstrong-Whitworth shunting locomotives for the L.M.S.R. is an enlargement of that of the **250** b.h.p. oil-electric unit which has given such good service on that railway for some two years. The bonnet, in addition to housing the engine, generator, and radiator, also contains the single traction motor, which drives the six wheels through a double reduction gear, jackshaft, and rods.

Unequal spacing of the wheels was found necessary to accommodate the jackshaft, and the **4** ft. **3** in. wheels are spread over a base of **14** ft. **6** in., and to allow the necessary flexibility on sharp curves in yards the centre wheels have a lateral play of $\frac{3}{4}$ in. per side. In addition to the normal horizontal and vertical stretchers, the main locomotive frames are strengthened by the jackshaft bearing hornblock casting on each frame plate, connected transversely by the motor bearer, which braces rigidly the two frames and jackshaft hornblocks against the alternating thrusts of the driving rods. Both welding and riveting have been used in the fabrication of the sheet steel bonnet and cab, and the bonnet has a large sliding cover above the engine to facilitate inspection of the cylinder heads and pistons. The main fuel tank, with a capacity of **545** gal., is mounted across the locomotive just in front of the cab and above it is a **90** gal. service tank from which the fuel is led to the injection pumps. Resting on the running plate along one side of the bonnet, and below the large inspection doors, is the battery, but to the front of it, two of the inspection doors are carried down to the running plate level. In the cab is a control desk with two control and two brake handles, and sanding levers, hand screw brake, cab heater, food cooker, &c., are conveniently located. The cab is much warmer but has side drop windows with arm rests embodied in the frames. The electric control equipment is housed in a cabinet against the front weatherboard and has a removable cover over it in the cab roof. A speedometer is fitted in the cab, and is driven from the intermediate gear wheel.

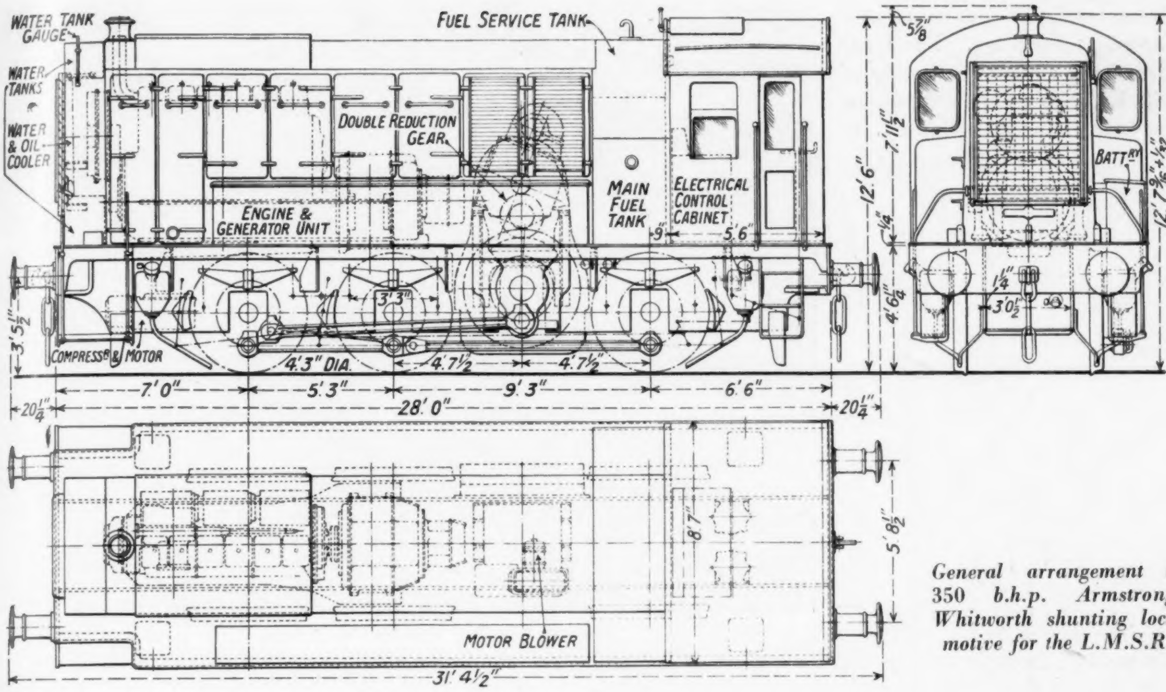
Braking is by the Westinghouse straight air and hand screw systems with one block on each wheel and compensated rigging. For fine control of shunting movements the air brake incorporates the Westinghouse self-lapping driver's brake valve. An interesting point about the brake rigging is that to accommodate the lateral play of $\frac{3}{4}$ in. per side of the centre wheel, the brake hangers for those shoes are of articulated form at the top to allow the shoes to follow the movement of the wheel and still be capable of application. The shoes are of cast iron and are applied to the wheel flange as well as to the tread. With **60** lb. per sq. in pressure in the two **13** in. diameter cylinders, the braking force is **38·4** tons. Air is supplied by a Westinghouse motor-driven compressor with a capacity of **25** cu. ft. of air per min. The springing system is on the four-point principle, the leading and intermediate springs on each side being connected by a compensating beam.



Armstrong-Whitworth shunting locomotives for the L.M.S.R. under erection at Scotswood works

The Engine

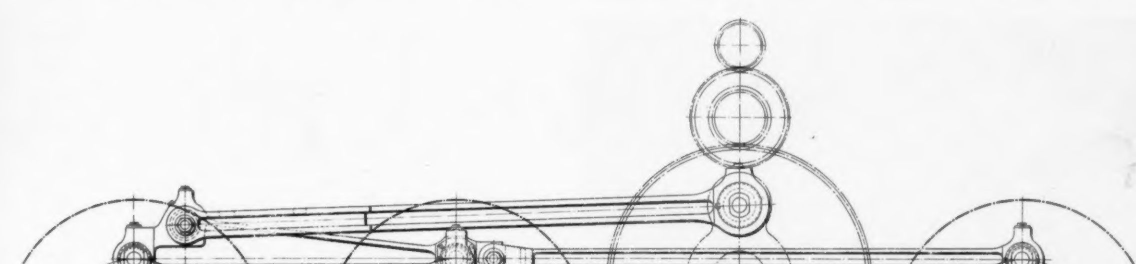
The design of the six-cylinder four-stroke Armstrong-Sulzer engine is something more than a mere enlargement of the **250** b.h.p. unit used in the original L.M.S.R. oil-electric shunter, and is of a higher-speed lighter-weight type. The continuous rating of **350** b.h.p. is obtained at **875** r.p.m. in cylinders having a bore and stroke of **220** mm. by **280** mm. (**8·65** in. by **11·0** in.). The top rating of **400** b.h.p. at **1,000** r.p.m. is available for one hour and the engine may thus be considered as conservatively



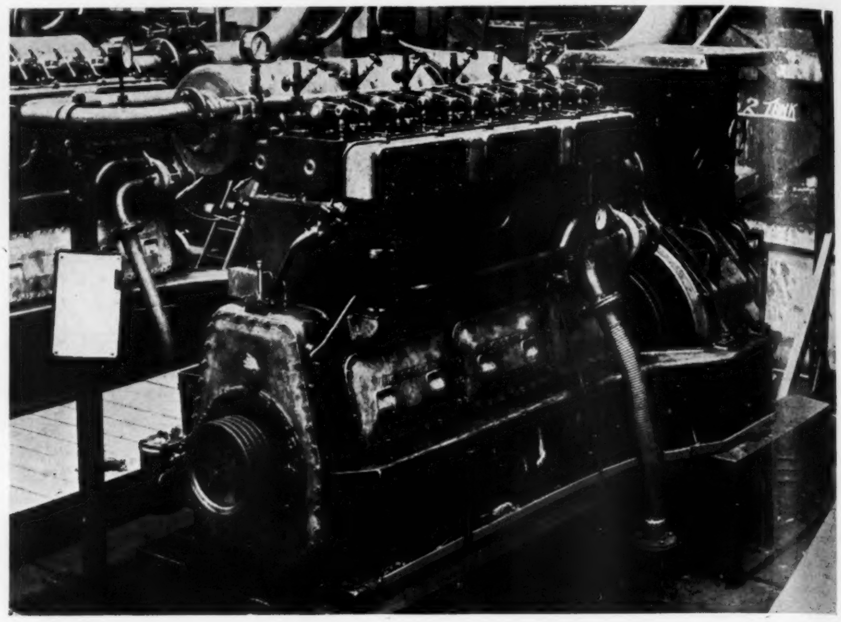
General arrangement of 350 b.h.p. Armstrong-Whitworth shunting locomotive for the L.M.S.R.

rated at the continuous output. Actually, the brake m.e.p. under the continuous conditions is 81 lb. per sq. in. and the piston speed 1,600 ft. per min. The weight of the engine, including the extended crank chamber forming the generator support is about 4 tons, equivalent to $22\frac{1}{2}$ lb. per b.h.p.

One of the main features of the engine design is the way in which weight has been reduced without impairing the strength by a combination of cast and welded constituents. The upper part of the cylinder block is a casting, the crankcase is of welded steel plate, and the five inner transverse stays of the crankcase (which support the main bearings) also are of welded steel plate. The transverse members at each end, carrying the outer bearings, are steel castings welded to the crankcase. The cylinder heads are separate iron castings and are encased in separately-cast aluminium covers. Each cylinder head contains the suction and exhaust valves and the centrally-located multi-hole fuel valve through which the fuel is injected directly into the cylinder. The fuel is strained



Rod drive as used on Armstrong-Whitworth oil-electric shunting locomotives

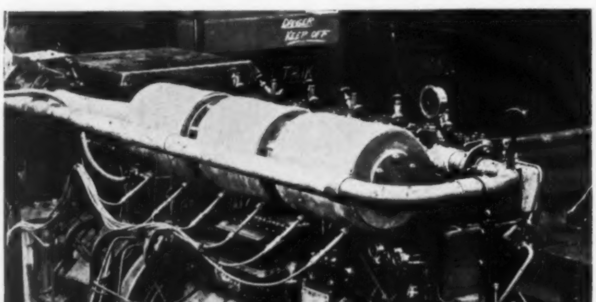


Armstrong-Sulzer engine on the test-bed at Scotswood. These engines have a continuous rating of 350 b.h.p. at 875 r.p.m. and a one-hour rating of 400 b.h.p. at 1,000 r.p.m.

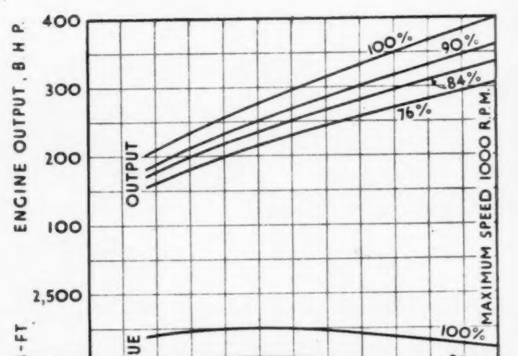
by passage through Zwicky and Auto-Klean filters and then through Bosch edge-type filters at the injection valves.

A gear-driven camshaft is mounted on the intake side of the engine and operates the air and exhaust valves through the normal push rods and rockers; on the opposite side of the engine is a further camshaft which operates the C.A.V.-Bosch fuel injection pump and governor. The fuel pump is arranged in two three-ram groups with the oil-operated governor between, the bottom half of the camshaft casing being cast solid with the cylinder block and with the governor casing and pump units studded to the top. The main pistons are of aluminium alloy and are connected to the nickel steel I section connecting rods by fully-floating gudgeon pins. The crankshaft and pins are hollow bored and the shaft is carried on seven bearings with a white metal lining on a steel shell; the big end bearings are of white metal on bronze shells. Pressure lubrication is applied to all working parts and the engine-driven pump for this purpose is located in the sump. The oil normally is kept at a pressure of 25 lb. per sq. in. and the speed and fuel control arrangement is such that failure of the pressure will shut down the engine.

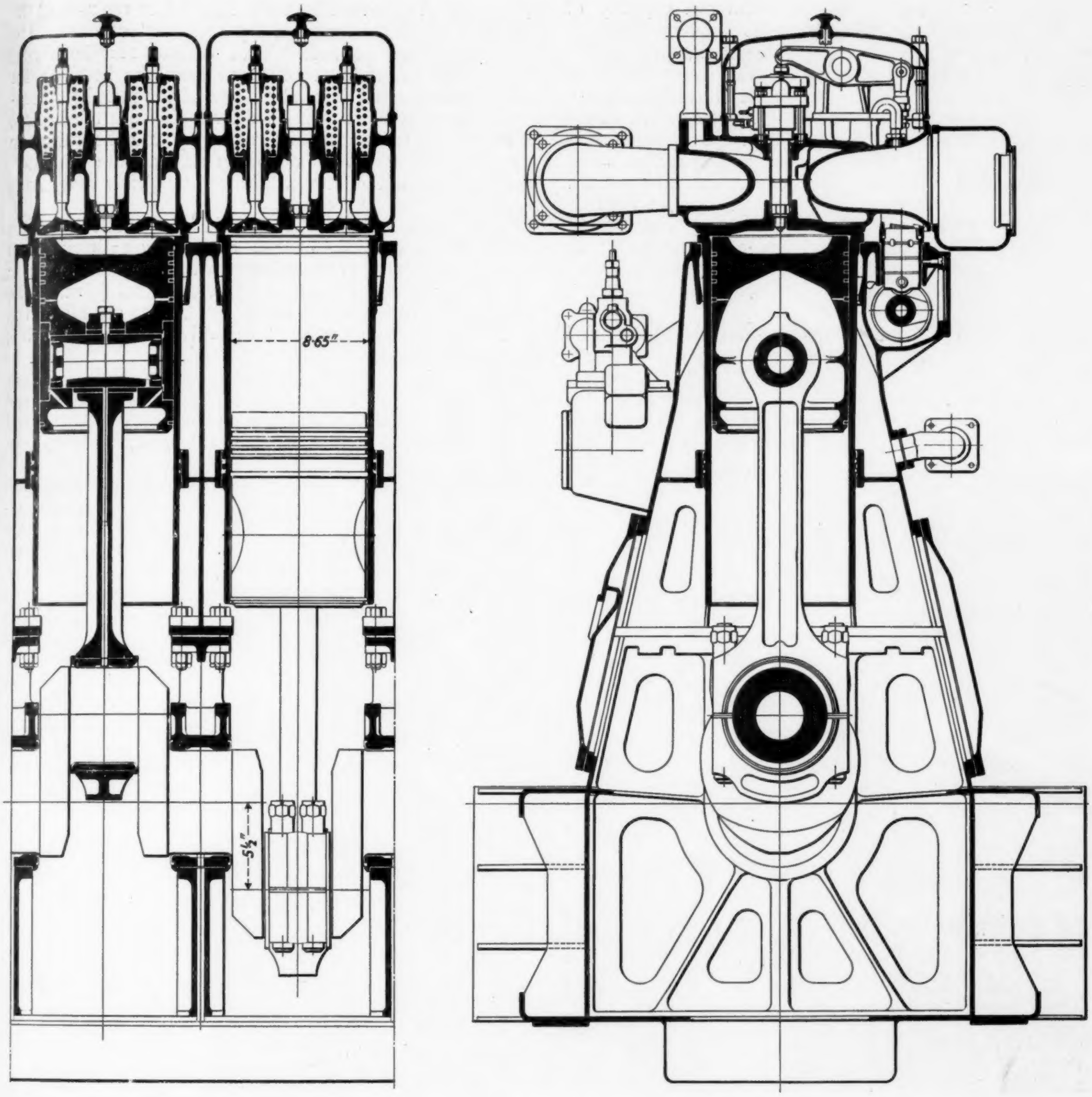
The lower part of the crankcase is of welded steel and



Fuel pump side of engine for L.M.S.R. shunters



Torque curves of 350 b.h.p. Armstrong-Sulzer engine



Longitudinal and cross sections of* 350 *b.h.p. Armstrong-Sulzer oil engine

serves as the bedplate of the engine and generator, as it is extended in the form of two arms at the back end. This bedplate is supported on the locomotive frame structure on machined faces with the intermediary of rubber pads. There are eight locating projections (also with rubber pads), two at the front end, one at each side of the engine and generator respectively, and two at the rear end of the generator. The circulating water and engine lubricating oil are cooled in Serck sectional radiators at the front of the bonnet. Ventilation of the radiators is effected by a Keith-Blackman fan belt-driven from the engine shaft, and the air is blown outwards and upwards through the radiator elements. The air is drawn into the bonnet through large louvres at the cab end. The silencer is of lagged steel pipe, integral with the exhaust manifold, and is in three sections bolted together alongside the engine; the exhaust from the silencer is turned up through a small funnel on top of the bonnet. The engine is started electrically, a 225 amp. hr. D.P. Kathanode lead-acid battery supplying current to the main generator.

The Transmission

The main constituents of the transmission are a directly coupled d.c. main generator with an overhung auxiliary generator of 8 kW. capacity; a single force-ventilated traction-motor with geared jackshaft and rod drive; and the Armstrong-Whitworth control apparatus. All this electrical equipment was supplied by Crompton, Parkinson & Co. Ltd. to Armstrong-Whitworth designs and specifications.

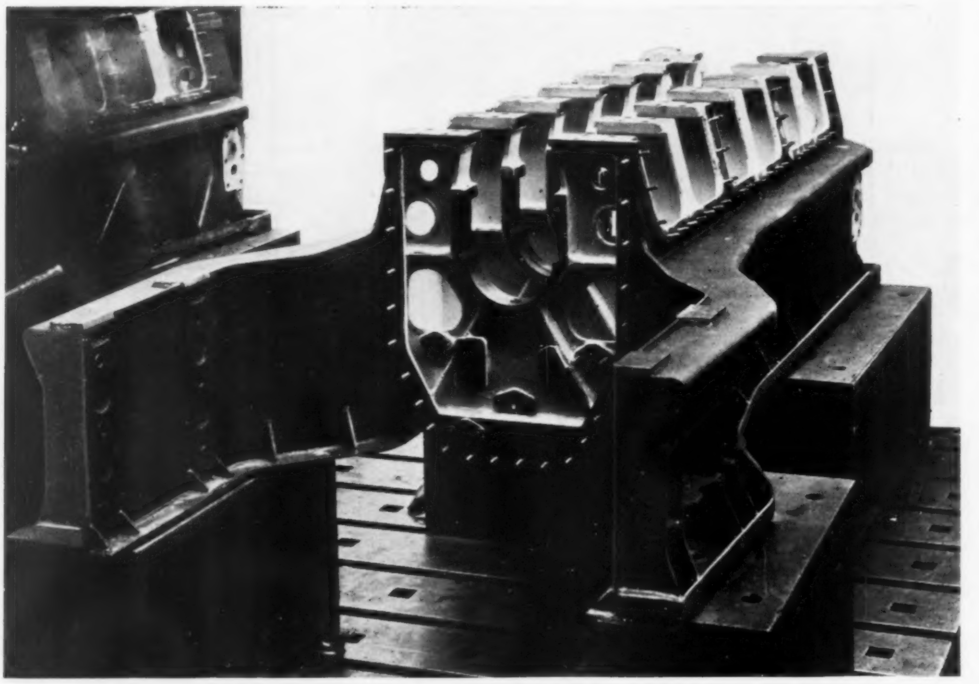
At the continuous engine speed of **875** r.p.m. the self-

ventilated main generator has a continuous capacity of 234 kW. at 530 volts 440 amp. The one-hour rating is 267 kW. at 485 volts 550 amp.; the maximum current supplied at starting is 800 amp. This main generator supplies current to a single springborne traction motor located in the rear end of the bonnet, and which drives the jackshaft through double reduction spur gears having a ratio of 11·1 to 1. These gears are arranged at one end of the armature shaft only. The continuous rating of the motor is 210 kW. at 600 volts 350 amp., and on the one-hour rating, 267 kW. at 510 volts 525 amp. The starting tractive effort produced by the motor is 30,000 lb.; on the continuous rating 9,100 lb., and on the one-hour rating 16,700 lb. The speed-tractive effort curve of the locomotive is reproduced with this article.

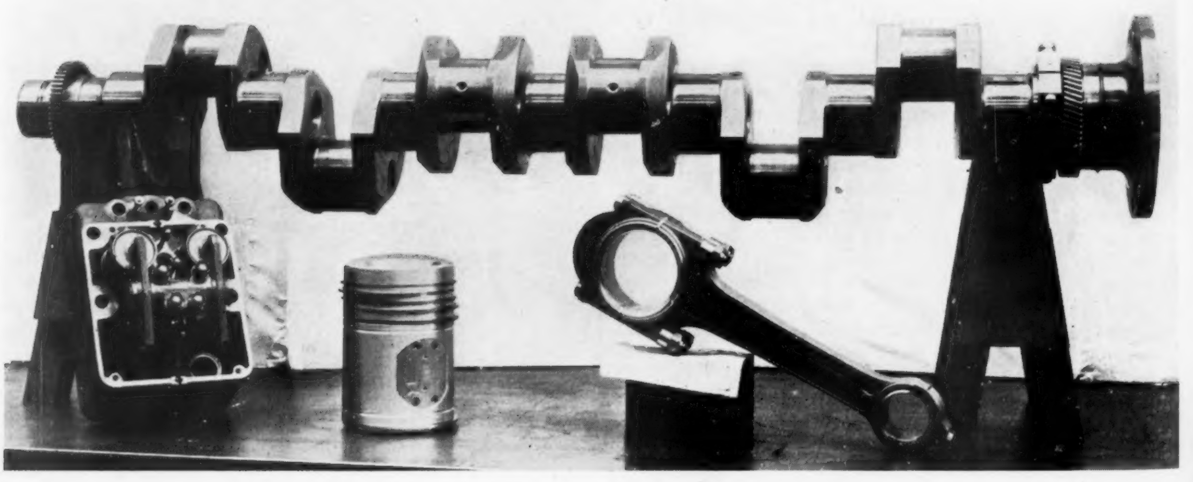
The jackshaft (whose load is mainly horizontal) is carried in bronze bearings which are split vertically and are white-metal lined on journal and end faces. These are each carried in a cast steel casing which is split on the horizontal plane and which is wedged into the jackshaft hornblocks in each main frame—the right-hand hornblock being integral with the above-mentioned gear casing and the left-hand hornblock being a separate steel casting. The two castings are connected with vertical and horizontal frame stays fabricated together to form the bedplate for the traction motor. The lubrication of the jackshaft bearings is by oil throwers which deliver oil from the bottom of the casing to the top of the bearing and the reduction gear is lubricated by an oil pump driven from the intermediate gear shaft. The jackshaft gear wheels were made by Alfred Wiseman Limited.

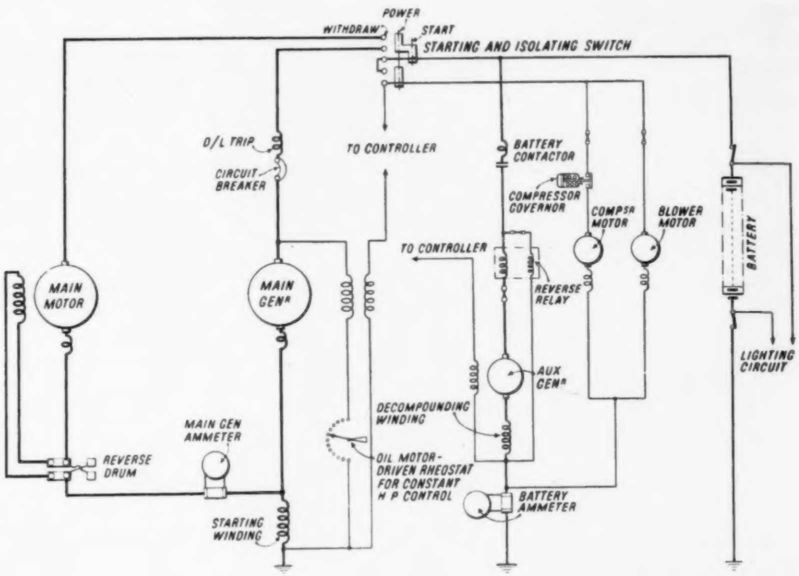
From the flycranks on the ends of the jackshaft the motor torque is transmitted through an I-section driving rod which is bifurcated over a triangular coupling rod to which the driving rod is connected by a spherical joint. The jackshaft and road wheel crank pin bushes are all of the normal bronze type; that at the driving rod big end is white-metal lined.

The running of the locomotive is regulated from a desk in the cab, beneath which all the control gear is housed on a frame which permits all of the apparatus being lifted or lowered *en bloc* through the cab roof, with only a

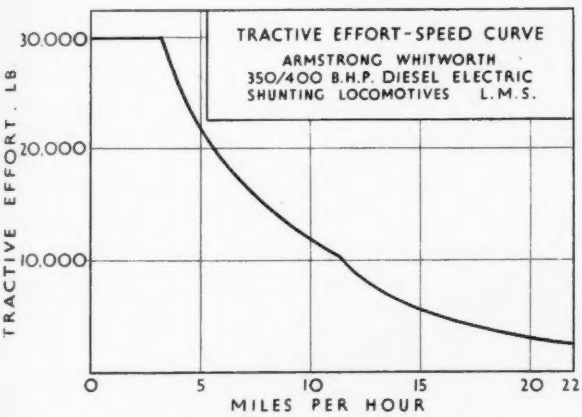


Components of 350 b.h.p. Armstrong-Sulzer oil engine. On the left is the crankcase and the bedplate for the engine and generator. Below is the crankshaft, an aluminium alloy piston, and a connecting rod. The cylinders of these engines are 8·65 in by 11·0 in. and the top speed is 1,000 r.p.m.





Right : Diagram of main circuits of the Armstrong-Whitworth 350 b.h.p. oil-electric locomotives for the L.M.S.R.



Below : Speed-tractive effort curve of Armstrong-Whitworth shunting locomotive

few simple electrical connections to break or make. This desk contains duplicate control and brake handles so that the driver may operate the locomotive from either side of the cab. A control handle regulates the speed of the oil engine and the current supplied by the generator to the traction motors. An automatic excitation regulator, mounted on the engine, and worked by oil pressure in conjunction with the engine governor, ensures that the output as set by the controller is maintained constantly by the engine. In this way it is possible to run the engine economically at any pre-selected speeds, in this case four (500, 675, 875, and 1,000 r.p.m.), and to prevent the engine from being overloaded. A foot-operated dead-man attachment is incorporated in the control. It is governed by pedals at each side of the cab and is set with a time lag of five seconds to allow the driver to move from one side of the cab to the other.

The Armstrong-Whitworth control enables the full rated output of the diesel engine to be developed. The main features are shown in the diagram. By means of an oil valve oil under pressure is admitted to one or other side of an oil motor. The oil valve is mechanically connected to the engine governor and responds to any slight change in the position of that instrument; the oil motor is mounted at the back of a rheostat, to whose spindle it is directly coupled. This rheostat controls the voltage of the main generator, from zero when the vehicle is starting, and from rest up to the maximum voltage when the vehicle is travelling at its full speed.

There is, of course, a certain position of the governor corresponding to full rated fuel admission; any slight overload causes a fall of this governor position, and a slight underload causes a rise. These small movements are transmitted to the oil valve, which then admits oil from the central pipe to the one immediately above or below.

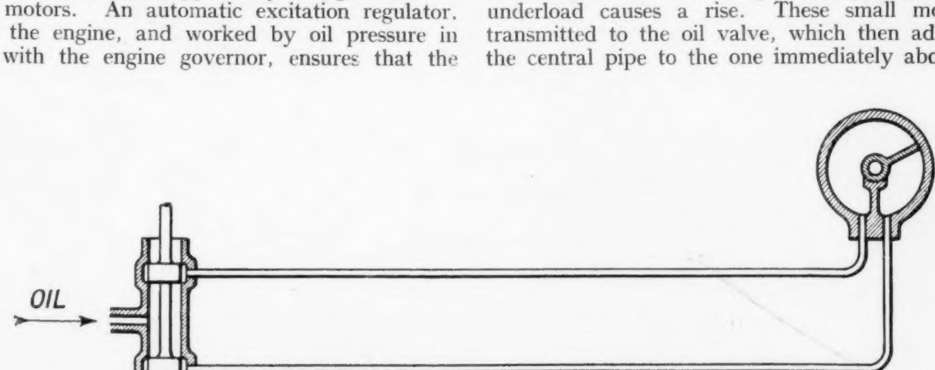
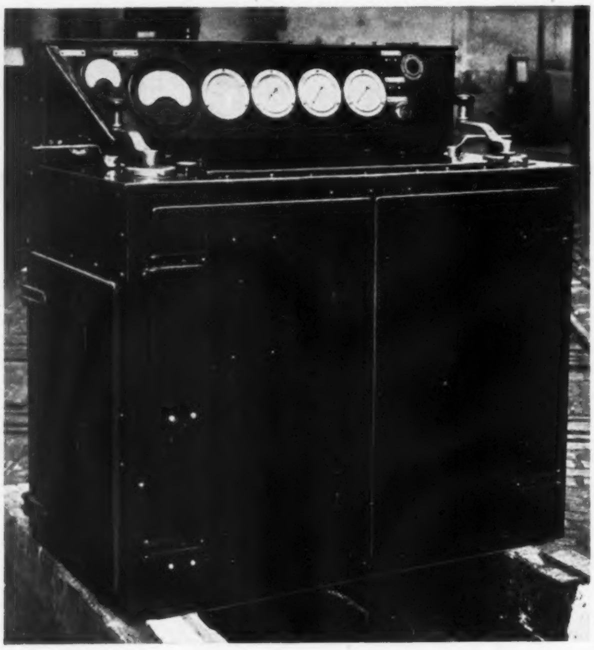


Diagram of Armstrong-Whitworth hydraulically-operated control gear



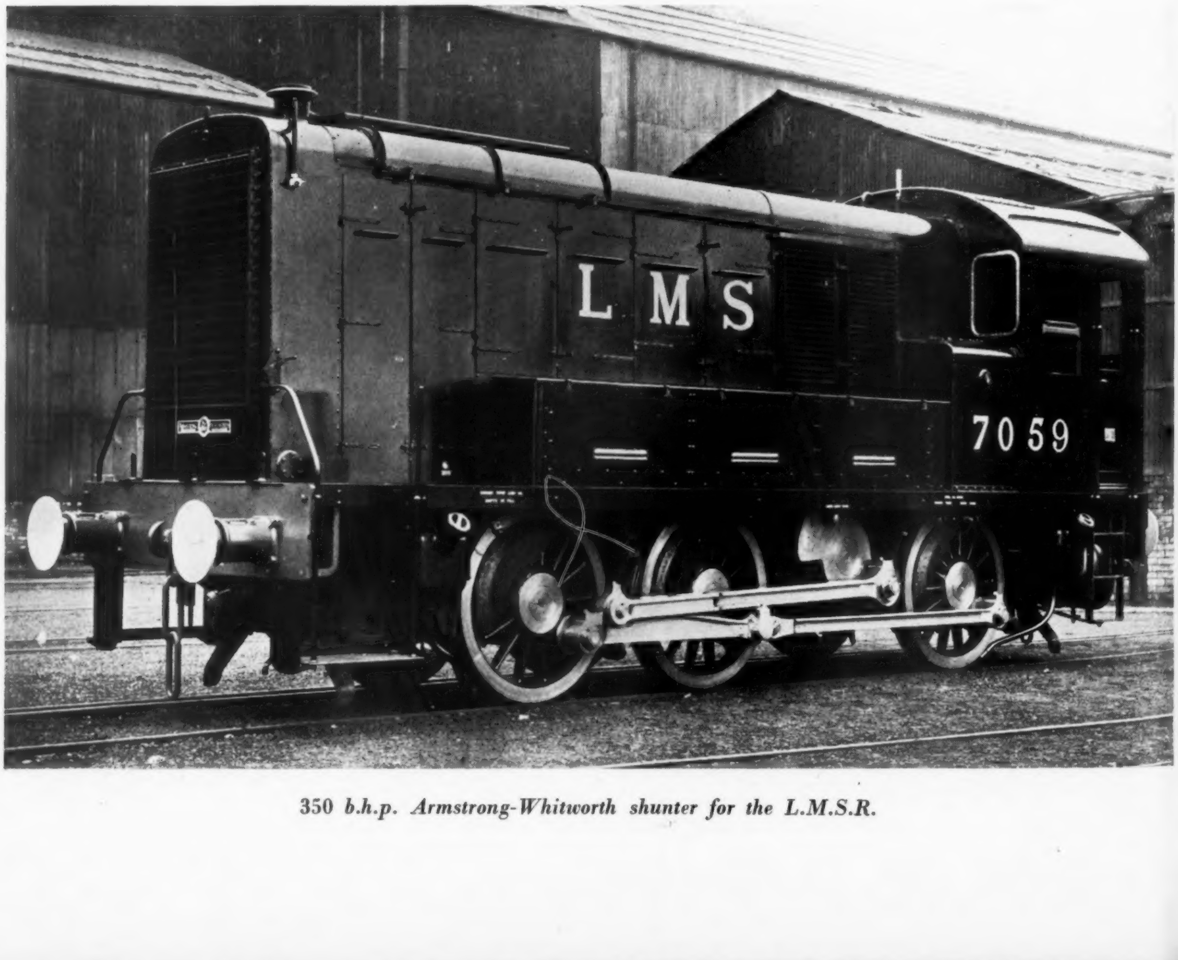
Control desk ready for mounting in cab of L.M.S.R. shunting locomotive

The pipe leading vertically down from the bottom of the valve is merely an oil drain back to the sump. The rotor of the oil motor responds to pressure in either of these pipes, turns in the required direction, and takes load off the engine or puts additional load on, by lowering or raising the voltage of the generator. This is immediately answered by the return of engine speed to normal, the ports in the oil valve closing, and the oil motor remaining in this position until a further change in train speed.

In the present case, the engine is designed for four running speeds, and change in the engine speed is effected by control of the governor spring pressure. The position of the governor itself, therefore, remains the same at whatever speed the driver selects, and the automatic control consequently functions in exactly the same manner as described and maintains the engine at full, or whatever fractional power has been chosen. No lubrication of parts is necessary, since each element is working in oil, and maintenance is therefore negligible; slight leakage of oil has no serious effect because the movements are self-correcting, and in practice it is found to control the engine horsepower within 2·5 per cent. over the fuel working range of the vehicle.

List of Subcontractors for the L.M.S.R. Shunters

Crompton, Parkinson & Co Ltd.	Electrical equipment.
D.P. Battery Co. Ltd...	Lead acid batteries.
C.A.V.-Bosch Limited	Fuel pumps, injection nozzles and filters.
Auto-Klean Strainers Limited	Fuel filters.
Serck Radiators Limited	Radiators.
Westinghouse Brake Co. Ltd.	Air brake equipment.
James Keith & Blackman Co. Ltd.	Fans and blowers.
Alfred Wiseman & Co. Ltd.	Jackshaft gear wheels.
Jonas Woodhead & Sons Ltd.	Bearing spring plates.
Geo. Turton, Platts & Co. Ltd.	Buffers.
Taylor Bros. & Co. Ltd.	Tyres and axles.
Kryn & Lahy (1928) Limited	Wheel centres.
Zwicky Limited	Fuel filters.



350 *b.h.p. Armstrong-Whitworth shunter for the L.M.S.R.*

THE BRAKING OF HIGH-SPEED DIESEL TRAINS

*By JOSEPH C. McCUNE, Assistant Director of Engineering, Westinghouse Air Brake Company, U.S.A.**

IT is doubted if all railroad men appreciate the complex and difficult problems encountered in producing stops with high-speed diesel trains in what might be considered reasonable distances. But substantial technical problems have to be surmounted to bring about an easy stop. The most basic of these problems arises from the tremendous kinetic energy. To bring about a stop, all of the energy possessed initially by the train must be converted to energy in some other form, since energy cannot be destroyed. Consequently, large quantities of heat are generated during a stop. It should be noted that heat is generated whenever the speed of the train is reduced through brake action. Service or emergency brake applications, braking ratios, brake-shoe loads, modify the effects of heat, but heat, as such, is inevitably produced whenever the train is stopped. One advantage of light-weight trains not always considered lies in the reduction of heat generated during brake applications. Evidently, in stopping a train from a given speed, the lighter the train the lesser the problem of dissipating the heat produced during the stop. If trains are to be operated at ultra-high speeds, the weight of the train is of great moment from the braking viewpoint.

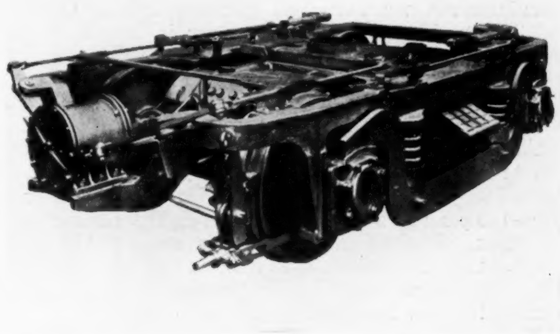
In considering an actual stop from high speed, immediately one factor becomes of the greatest consequence; that is: "What adhesion is available throughout the stop?" Everyone understands that a train is actually stopped by the retarding force set up between wheel and rail by action of the brakes and that the magnitude of this force is dependent upon adhesion. Obviously if the adhesion is low, the retarding forces must be low, and consequently the stop long. Particularly, if the adhesion is low at very high speeds, long stops must be expected because the retardation would then be low when the speed was greatest. To make a short stop, the retardation should be high when the speed is high because then the greatest distance is being covered per unit of time. Probably the greatest value of the Zephyr tests, as affecting future brake development, lies in what was learned about adhesion at high speeds.

Tests on the Burlington Zephyr

Tests with the Zephyr established that although the brake-shoe friction varies with speed, it varies in a uniform manner from the lowest to the highest speed; that is, no evidence was found to support the view that the characteristics of brake-shoe friction alter markedly after some relatively high speed is attained. Tests from the 100 m.p.h. zone were entirely consistent with stops in the lower speed zones. More explicitly, it has always heretofore been found that an increased braking ratio produced a shorter stop for any speed within the range encountered in these tests. Prior to the tests it was thought possible that a negligible gain might be experienced as a result of an increased braking ratio at very high speeds. Such results were not actually found. At a nominal speed of 100 m.p.h., a reduction in the braking ratio of the train from 175 per cent. to 135 per cent. lengthened the stop about 600 ft. A reduction to 123 per cent. added some 300 ft. additional to the stop distance; a reduction to 97 per cent. lengthened the stop again by some 800 ft.

In the 80-90 m.p.h. speed zone, wheel slippage did not result from application of braking ratios of 330, 305, 290,

* In a paper read before the Western Railway Club, Chicago.



Driving truck of the Burlington Zephyr showing the Westinghouse brake cylinder and clasp rigging

275 and 265 per cent. It should be understood that these braking ratios cannot be compared with the conventional braking ratios which are maintained throughout the stop. The test braking ratios were applied at constant high speed. These tests indicate that very high braking ratios can be applied at high speeds, if protective apparatus is supplied to guard against wheel slippage at low speeds. The evidence at hand indicates that no major reduction in adhesion occurs at high speeds. This conclusion is of the greatest practical consequence because it establishes that high retardation can be set up at high speed without wheel slippage. By means of special apparatus, which guards against slippage at lower speeds, it is possible to use higher braking ratios than formerly.

Performance of the Brake Shoes

The Zephyr tests supplied an opportunity to observe in actual train tests the performance of brake shoes (plain, diamond S, chilled) under the combined influence of heavy loads and very high speeds. The brake shoe performance was normal under all conditions although exhibiting effects which would ordinarily be expected. That is, the degree to which the shoe was heated increased with the shoe load and the speed. The amount of metal removed increased with increase in these two factors, but not to any disturbing extent. With high energy dissipation rates, the molten metal from the brake shoe would adhere to the wheel but much of it was of a flaky character and only temporarily attached to the wheel. That portion more permanently fastened to the wheel produced no discernible bad effects. The molten metal constituted a fire hazard to the right of way, but this hazard appeared to be only slightly affected by the braking ratio. In nominal 100 m.p.h. stops, in one case with a train braking ratio of 175 per cent. and in the other with a ratio of 97 per cent., it was found that brake shoe metal was deposited on the motor truck wheels in each case but in so far as visual inspection disclosed, to no greatly differing degree. Metal was deposited upon the wheel only in cases of stops from high speeds. In such instances, a very thin coat of brake shoe metal appeared bonded to the wheel over irregular and variously spaced areas.

The rate of wear of the brake shoes was not as

rapid as had been anticipated. During the entire series of tests, only seven shoes were replaced, and five of these were renewed prior to the tests proper because they previously had been worn to a degree which it was believed would not permit them to last throughout the contemplated test programme. Two shoes were replaced on the No. 1 or motor truck before the tests were completed. One of these was renewed because it was feared that the shoe was too thin for stops from **100** m.p.h. although the tests later made showed this fear unjustified. One shoe on this truck was replaced because it had been worn too thin at one end during the testing. This shoe was 1½ in. thick when the test programme started.

Prior to the tests, there had been concern that the motor truck wheels would become overheated due to the heavy braking and the weight on the motor axles, which during the tests was approximately **50,000** lb. Consequently, portable pyrometers were employed to read wheel-tread temperatures as soon as possible after the completion of the stops. In the four stops from a nominal **100** m.p.h. speed, the tread temperatures read on the first wheel were **480**, **390**, **350** and **240**° F. In the other tests, a temperature as high as **300**° was seldom observed.

Equalisation of Brake Work Between Trucks

The Zephyr is equipped with a retardation controller which responds to the retardation of the train. Whenever the retardation of the train itself attains a predetermined value, further admission of air to the brake cylinder is cut off. If the retardation thereafter increases to a predetermined higher value, cylinder pressure is released. By electrical means, one controller governs all cylinders in the train.

The retardation of the train is brought about by the combined action of the retarding forces set up between wheel and rail at each of the four trucks due to the brake application on these trucks. It is obvious that the retarding force between wheel and rail at one truck may not bear the same relation to the weight on the truck as exists at some other truck. But if this ratio becomes too high (that is, exceeds the coefficient of adhesion) sliding will occur. Stated differently, one truck may be so overbraked that wheel sliding is inevitable, while at the same time an adjacent truck may be so underbraked as to make wheel sliding a remote contingency. The retardation controller determines if the train as a unit is overbraked. Consequently, if one truck is overbraked, and at the same time another truck underbraked, one condition may compensate for the other so that the train as a unit appears to be properly braked. If the retardation controller, which registers the retardation of the train, is to guard against overbraking on any one individual truck, and at the same time permit a high rate of retardation, obviously the degree of braking must be made the same on all trucks as nearly as practicable.

The tests indicated that the type of retardation controller installed on the Zephyr should have a difference in its setting of about **1** m.p.h. per sec. to prevent " cycling," and that a release setting of **4·5** m.p.h. per sec. could be employed after the rear truck had been equalised with the other trucks, without intolerable wheel sliding resulting.

The tentative conclusions drawn from the brake tests on the Zephyr are as follows:—

1.—The friction of brake shoes in the **80-100** m.p.h. speed zone is determined by the same influences as in the **60-80** m.p.h. zone. That is, the brake-shoe friction at very high speed is entirely consistent with that heretofore experienced in the lower speed zone and does not, as thought possible prior to the tests, attain normally low values in the **100** m.p.h. zone.

2.—The adhesion between wheel and rail does not change markedly at the highest speed and may be entirely independent of speed, although the independence of speed and adhesion was not established beyond any question.

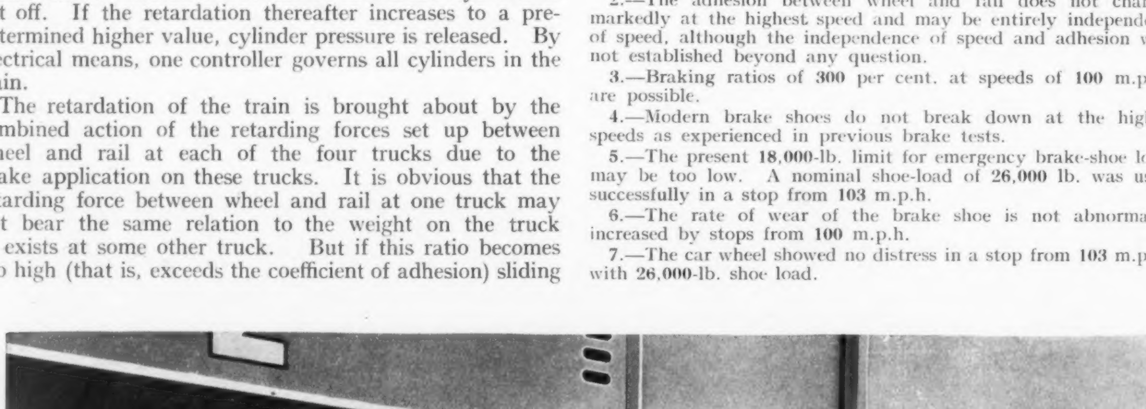
3.—Braking ratios of **300** per cent. at speeds of **100** m.p.h. are possible.

4.—Modern brake shoes do not break down at the higher speeds as experienced in previous brake tests.

5.—The present **18,000**-lb. limit for emergency brake-shoe load may be too low. A nominal shoe-load of **26,000** lb. was used successfully in a stop from **103** m.p.h.

6.—The rate of wear of the brake shoe is not abnormally increased by stops from **100** m.p.h.

7.—The car wheel showed no distress in a stop from **103** m.p.h. with **26,000**-lb. shoe load.



Electro-magnetic track brakes of the Knorr type as fitted to the German high speed diesel trains

8.—The car wheel requires an appreciable interval to cease revolving during a slide.

9.—The coefficient of brake-shoe friction decreases as the shoe load increases. A braking ratio of 127 per cent. with 4,730-lb. shoe pressure was as effective as 152 per cent. with 18,850-lb. shoe pressure.

10.—An inertia device, the retardation controller, permitted high braking ratios at high speed because it limited the braking ratio at low speeds.

11.—The brake equipment installed on the Zephyr was effective and flexible, although handicapped by a low braking ratio.

12.—No fundamental physical limitations were found which would preclude, with further development in the brake art, stops of trains of the Zephyr type from 90-100 m.p.h. in the approximate distances required for every-day conventional locomotive trains from speeds of 60-70 m.p.h.

THE SANTA FE FIRE

SINCE the publication of the issue of this Supplement for February 21, in which we dealt, on page 379, with the fire which broke out on November 20, on the largest diesel locomotive in the world (the double-unit 3,600 b.h.p. locomotive of the A.T.S.F. Railroad) the report of the Interstate Commerce Commission on this accident has been issued, and gives the following information.

The tanks in the baggage car were refilled at Albuquerque, 160 miles east of Gallup, and then contained 3,385 [U.S.] gal. of oil. Refueling of the rear engine unit was completed shortly before reaching Gallup and the tanks on the front unit would then have been refilled had not the operation been delayed by the stop at Gallup. Upon leaving the station the fireman and the attendant whose duty it was to operate the refueling pumps were called upon to transfer lubricating oil from the rear to the front engine unit. While this work was being performed the fire occurred.

The examination after the fire had been extinguished disclosed the fact that the pin which should have been in the lever operating the clutch driving the refueling pump on the front engine unit was missing and the clutch was partly engaged. The gate valve to the pump which should have been closed was more than half open. This permitted the pump to operate and after the fuel tanks had been filled, the surplus escaped through the vent pipes, part of it dropping on to the engine room floor and part of it being broken up into a fine spray by the blast from the rear ventilating fan which made a highly combustible mixture.

An examination of the track showed that oil had been escaping for about four miles, indicating that the refueling pump must have gone into operation soon after the train left Gallup. The wastage was about 350 gallons.

The direct cause of the accident was improperly located outlets to the vent pipes which discharged the overflow from the fuel oil tanks into the engine room.

The oil tanks overflowed, in the absence of an attendant, by oil from a hose line extending from tanks in a baggage car to a refueling pump in the engine room of the unit. Manually operated stop valves in the hose line, at the tanks in the baggage car and at the refueling pump inlet, were found in open position. The jaws of the clutch mounted on one end of the air compressor shaft that drove the refueling pump, which was used for transferring oil through the hose line to the fuel tanks of the unit, were found engaged and the pin provided to hold the clutch handle in off position was not in place. The cause or causes, for engagement of the clutch, and the manually operated stop valve at the inlet of the refueling pump being opened, could not be determined. The stop valve at the tanks in the baggage car had been left open by the attendant after completion of refueling of the second unit, as he had anticipated refueling the first unit immediately thereafter, but this operation was interfered with by the stop the train made at Gallup and by being called upon to perform other work when leaving Gallup. The presence of this refueling arrangement on the unit was a violation of Rule 256 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, which reads: "Fuel reservoirs shall be arranged so they can be filled only from outside of the cab or other compartments."

The fuel oil that was discharged into the engine room from the vicinity of the roof was mixed with air by a strong blast from the cooling and ventilating fans driven from the rear main engine and formed a readily combustible mixture. The exact cause of ignition was not determined, but a number of theories were advanced as to the possible causes, among which are the following: Mixture being blown against the hot exhaust stack of the auxiliary engine, the smokestack of the heating boiler, the hot casting on top of the heating boiler, or drawn through the slotted openings into the boiler fans and thence blown against the red hot cover of the combustion chamber of the heating boiler. Sparking at commutators of heating-boiler motors or auxiliary generator. Sparking at storage-battery connections, temporary connection having been made across three front cells by clips and loose wiring which were found on top of the batteries after the fire. Sparks from the brake shoes at the time the running test of the brakes was made leaving Gallup.

While there was normally considerable oil scattered on the trucks, piping, and fuel tanks, those who participated in the investigation were generally of the opinion that the source of the fire was within the engine room, rather than external.

Estonian Railway Order.—Included in a large order for traction material recently placed by the Estonian State Railways are four diesel railcars, and four engines for incorporation in vehicles that are being converted to diesel traction.

Canadian Diesel Mileages.—Before the Association of Railway Electrical Engineers, Mr. R. G. Gage, Chief Electrical Engineer, Canadian National Railways, stated that this company was endeavouring to get a mileage of 200,000 between general overhauls from its diesel-electric railcars, and in most cases this had been attained.

Nord High-Speed Trains.—Since going into service between Paris, Lille and Tourcoing at the end of July, 1934, the two 820 b.h.p. triple-car streamlined trains of the Nord have covered 190,000 miles, equivalent to approximately 62,000 miles a year for each set. Eight further rakes are now under construction, and we understand that one of these will have the Maybach engines supercharged up to 600 b.h.p. each.

French Diesel Engine Competition.—Once again the French Automobile Club is to organise competitive tests on diesel engines suitable for standard gauge railcars. The tests will begin on May 1 next, and it is understood that among the engines entered for the competition are :—300 b.h.p. 12-cylinder Renault ; 500 b.h.p. 16-cylinder V Renault ; Als-Thom-Ganz 220-275 b.h.p. ; Corpet-Louvet (Frichs) 8-cylinder 300 b.h.p. and 12-cylinder Vee 400 b.h.p. All the above engines are of the four-stroke type, but two two-stroke engines have been entered by C.L.M., the first of 250 b.h.p. and the second of 500 b.h.p.

A SYMPOSIUM ON RAILCARS

*Abridged versions of four papers read on March 3 before a joint meeting of eight technical societies and organised by the Institution of Automobile Engineers**

Compression-Ignition Engines for Rail Traction

By H. D. BUSH

VIBRATIONS are set up by deflection of the rails, eccentricity of the wheels and tyre flats, resulting in a periodic motion of the vehicle in approximately a vertical direction, which impose a pressure varying in magnitude upon the underframe due to the weight of the power unit, and which may be as much as 14 per cent. of its weight. Oscillations are caused by wheels of unequal diameter, rail and crossing gaps, acceleration and deceleration of the car giving periodic movements in approximately a horizontal direction, and setting up forces upon the engine which may be more than 9 per cent. of its weight. Rolling, giving a periodic movement about an axis parallel to the track, is influenced by the balance of the car body and underframe, the position of the centre of gravity, track curves, and the design of the spring supports, which may impose a force upon the engine equivalent to 17 per cent. of its weight. A complete study of these forces involves a series of intricate mathematical calculations, and necessitates taking into account the natural frequency of the car and treating the unbalanced forces of each cylinder as acting separately upon the car frame. Taking into account the foregoing, the power unit should preferably be placed in the railcar with its centre of gravity directly over the bolster pin, in order to reduce to a minimum the effect of the forces and vibrations upon the engine and to take advantage of installing the engine at the strongest part of the car structure.

The accompanying table shows the principal average characteristics of some of the Beardmore-engined Canadian National cars taken over an approximate ten-year period, together with the performance data for the month of October, 1935.

The fuel consumption variation is due to different trailing loads and average speeds. The lubricating-oil consumption variations are chiefly due to each engine running at the idling speed over different periods, piston wear, renewal of oil, and similar considerations.

Mechanical Transmissions

By MAJOR W. G. WILSON

The starting of the car, when fitted with a hydraulic coupling, is usually carried out without arresting the engine by that fitting which is eminently suited to taking up the variation in engine/vehicle speed when starting from rest. Further, it suffers from none of the inherent disadvantages of the friction clutch, and requires no special attention beyond keeping the oil at the correct level and occasional attention to the packing gland.

* See editorial reference on front page.

M.A.N. railcar engine normally giving 480 b.h.p. at 900 r.p.m. fitted with Büchi supercharger to give 600 b.h.p.

The geared mechanical drives available that are known to the author and which are actually in service can be classified as follows:—

Epicyclic :
- Compressed air and mechanically operated .. Wilson.
- Electrically operated .. .. Cotal.

Spur :
- Air or oil operated .. .. Mylius, Maybach, S. L. M.

In the Cotal box the epicyclic trains are used in series. A disadvantage of this type lies in the fact that the ratio of first to second must be the same as third to fourth, though it is advantageous to have third and fourth much closer than first and second. Electro-magnetic clutches connect the respective members either together or to fixed reaction members held on the casing. The Wilson box differs considerably from the Cotal, and is a compound-

OPERATING CHARACTERISTICS OF EIGHT 200 B.H.P. CANADIAN NATIONAL RAILWAYS DIESEL-ELECTRIC RAILCARS OVER TEN YEARS' SERVICE

Railcar number	Date placed in service	Miles completed to the end of October, 1934	Average mile service per year	Average equipment availability from date of service, per cent.	Average fuel consumption in gallons per 1,000 ton-miles	Average lubricating oil consumption in miles per gallon	For month of October, 1935		
							Availability, per cent.	Fuel oil consumption	Lubricating oil consumption
15819	22.9.25	531,544	53,100	83	3·22	59·52	78	3·0	47·3
15820	16.11.25	396,711	39,850	81	3·63	59·54	100	4·6	189·8
15821	24.11.25	370,541	37,300	86	4·40	68·55	100	2·8	79
15822	27.11.25	371,893	37,500	86	3·38	64·10	98	4·0	60
15823	3.5.26	341,135	34,610	88	3·41	67·65	100	3·5	190
15824	15.2.26	358,234	36,650	83	3·14	55·20	98	3·2	51
15825	11.1.26	480,244	48,650	90	3·13	87·56	100	3·0	217
15831	6.7.29	251,486	37,400	89	3·15	40·39	100	4·3	75

train type, in which brake bands encircle the drums and their application is entirely external. The means of application of these bands vary, but, broadly speaking, they can be said to be mechanically operated. A clutch engages the direct drive. Only one clutch or reaction brake is applied at a time, and extra ratios can be provided by the interposition of an extra gear train and brake. The number of compound trains that can be used is almost indefinite and large torque ratios are available.

It is necessary in most cases to provide some form of remote control for the gear-change for use with coupled gears or coupled cars, each having its own motive power. The operation by self-contained compressed air cylinders does not alter in any way the principle of the band brakes, and it merely means that these are applied through the medium of a cam and cam-plate operated by an extension of the piston-rod.

In a considerable number of cases the gearbox and power unit are mounted on the driving bogie, which considerably eases the work of the propeller shafts and universal joints, as these then have only to accommodate the variations in position of the axle in relation to the bogie framing. A chain for the final drive does not appear to attain the popularity which it may deserve when its advantages are taken into consideration. It is well known that a chain provides a desirable degree of flexibility on the drive, and this no doubt does go a long way towards absorbing the rail shocks which tend to be transmitted through the transmission when using propeller shafts. A further advantage lies in the fact that a chain drive dispenses with a proportion of the mass of unsprung weight which must be associated with other types, and which is often carried at the centre of the axle.

The final drive by worm gear is one which has found much favour and there is no question but that this provides a very smooth and quiet drive and its casing can very frequently be conveniently arranged to carry the reverse gear also. Its mass effects are considerable, especially when the gear is mounted in the centre of the axle, unless steps are taken to provide a side mounting, which relieves the axle of considerable stress. The bevel type of final drive obviously offers many advantages in so far as the

Armstrong-Saurer 140 b.h.p. diesel-electric railcar belonging to the Buenos Ayres Western Railway

mass effect is reduced compared with that of a worm drive, and also that a reverse gear is very simply obtained by the provision of two driving pinions instead of one, each being situated on opposite sides of the crown wheel, and capable of being dogged to the driving shaft at will.

Railcars—Chassis and Bodywork

By C. J. H. TRUTCH

Streamlining, which is the subject of so much discussion in these days, is only necessary in cases where the vehicle is required for long-distance running at high speeds, *i.e.,*

Below: Bogie of Lorraine railcar fitted with 130 b.h.p. engine running at 1,600 r.p.m., Vulcan-Sinclair fluid coupling, and Wilson five-speed epicyclic gearbox

Above: Double-engined Lorraine diesel-mechanical car of 260 b.h.p. as used by the French State and Eastern Railways for track speeds up to 80 m.p.h.

where long distances are covered in relatively flat country at speeds over, say, 60 m.p.h. In cases where stops are frequent and/or where the line is heavily graded, streamlining is of little necessity from the point of view of tractive resistance, because the deciding factors both in power requirement and average speed, lie in the power required for acceleration and in climbing the grades.

It will be understood that it is almost impossible to calculate accurately the balancing speed of a railcar at high speed on level track, and that often, if an approximation can be arrived at, the results in practice will vary considerably under different conditions of wind. It follows from this that it is very undesirable for railways to specify only a maximum speed on level track, as, by so doing, a variety of different powers may easily be quoted, according to the conservatism and knowledge—or lack of either—of the manufacturer making the offer. The only safe way of obtaining comparable proposals and of being certain of getting a vehicle to meet the required conditions is to give the manufacturer full particulars of the route and of the minimum and normal timings required over it.

The Buenos Ayres Western railcar illustrated in these notes has a relatively heavy frame, capable of hauling goods vans or standard coaches, and carries a body of light construction. This body is of all-steel construction and the design follows the general lines of bus construction, but with a stiffer framing and somewhat heavier panelling. The body framing is built on to the floor bearers, which are bolted to the underframe members in the same manner as a road bus body is attached to its chassis. The engine is installed in a small engine room transversely across the car, being arranged in a sub-frame on rollers so that it can be readily withdrawn on to a platform in the shed for maintenance.

The construction of light railcars or railbuses entails different considerations from those of the heavy class. Apart from any advantage gained at high speeds by streamlining, the performance of a solo vehicle depends entirely upon its power/weight ratio, and it will therefore be obvious that some compromise must be struck between weight, cost and life.

In the case of integral construction, the floor bearers are welded or riveted to the underframe members, or where the underframe is self-supporting, rubber or leather cushioning pads may be interposed to reduce the transmission of vibration. Further rubber cushioning may be also provided at bogie centres and bearing springs. The window and door frames are generally of light aluminium alloy castings. All parts of the steel framing are treated with corrosion-resisting paint, and the inner sides of roof and side sheets may be sprayed with asbestos compound to prevent drumming and to insulate the body. In some cases the back of the interior panelling is also covered with insulating material to reduce the transmission of noise, as is also the underside of the floor sheets. Windows are usually of the half-drop type common on road vehicles, the top half dropping outside the lower half, and so obviating the pocketing necessary to accommodate a full-drop type. This reduces the thickness and weight of the body structure. An alternative is to use fixed lights with adjustable louvre ventilators over them.

Railcars—Their Effect on Public Transport and Railways

By JULIAN TRITTON

The problem may be studied by an examination of two questions—first, " Do the public want railcars? " and, secondly, " Do the railways want them? " The answer is in both cases a conditional one. The public want railcars if they cheapen the cost of transport, and give facilities which are not available by other means. The railways want railcars if they can show a saving over their present methods of dealing with light loads without sacrifice of the three great railway assets—reliability, speed, and safety—and on condition (a most important proviso) that they can be made to fit in with their main business of heavy and bulk transport.

It must be realised that more people live along a road than around a station or along a railway line, and the bus which passes the door will always have preference for short journeys over the train or railcar, unless compensating advantages of speed, comfort, and safety are offered, frequency of service being a common factor. From this it follows that the railcar must operate in sparsely populated districts *under conditions as similar as possible to those under which the road bus operates, i.e.,* with frequent stops, high acceleration, close headway, and punctuality.

Instances have frequently occurred in which a railcar service has increased traffic beyond its own capacity, and the railcar has then been replaced by the older type of steam train, but running to the original steam-train timings. The result has been that traffic has again fallen off. The obvious remedy was to increase the number of

Local passenger train on the Hungarian State Railways, hauled by two Ganz 135 b.h.p. railcars (first and third vehicles)

railcars or to increase the capacity of the units without decreasing their speed and frequency.

The use of railcars for ultra high-speed interurban services is of more recent origin, following the technical developments of light-weight streamlined construction. Here the advantage of high speed between terminals compensates for the extra time involved in reaching and leaving the terminals, and high speed can be accomplished with greater safety and comfort than on the road. Speed and comfort therefore become the primary considerations. The more precise the operating department can be in their requirements, the more efficiently can the car be designed and operated. There have been as many disappointments in the past from running heavy expensive cars uneconomically on light schedules as from overloading light cars with trailers and fast schedules in an effort to increase their capacity beyond their designed limits.

The question of trailers is always a thorny one. If a railcar has to be designed to haul a trailer, the necessary stiffening of the underframe to take the buffing and pulling stresses may add 20 per cent. to the tare weight. The addition is cumulative in that the extra weight requires a more powerful engine, larger tanks and auxiliaries, which themselves add further to the weight. So that when operating even with a specially designed light trailer, the power-weight ratio may be reduced by one half. The trailer also introduces traffic difficulties if it has to be shunted to the other end of the car for return journeys, while if, to avoid this, the trailer is fitted with a driving compartment at one end, the controls become complicated and expensive. In the author's opinion, it is doubtful whether the *occasional* necessity to haul a trailer justifies the extra initial cost.

The Discussion—and a Commentary

Mr. L. W. R. Robertson, of the Coventry Pneumatic Tyred Railcar Co. Ltd., opened the discussion with some general remarks on railcars and their operation, and proceeded to a plea for the pneumatic-tyred railcar as giving the public a fast and silent service, but he was inclined to pass over the limitation of a maximum of about one ton per wheel and the resulting 16 wheels for a seating capacity of 56 without the provision for trailer haulage. Mr. Robertson was followed by Mr. T. H. Hornbuckle, the "father" of the L.M.S.R. diesel cars and shunting locomotives, who brought forward the disadvantages of the railcar by quoting their unsuitability for market day traffic, and mentioned that the light type of car did not always operate the track circuits. But he emphasised a salient point that railcars must increase the revenue of the railway and not merely transfer some of it from steam trains. He doubted whether the public would be willing to pay a supplement to travel in cars of normal type, a view the latest emphatic refutation of which is the experiences with the Ganz diesel cars on the Cairo-Helwan line in Egypt. Mr. Hornbuckle was inclined to throw cold water on the suggestion in Mr. Trutch's paper that vehicles of pleasing appearance may succeed in obtaining more traffic for the railway than a vehicle of less pleasing exterior, saying that if Buckingham Palace was put on wheels it would not get passengers if it was running in the opposite direction to that desired by travellers. But surely it is the railway company's business to see that it *is* running at the right time in the right direction, and, given this, an attractive and comfortable vehicle will always recapture more traffic than a Black Maria running to the same schedule. Experience with the attractive blue and cream vehicles in Belgium confirms this view.

Commenting upon a map which Mr. Tritton showed on the screen giving the routes worked over in Great Britain and Ireland by steam, oil, and petrol railcars, Mr. C. F. Cleaver, of the A.E.C., mentioned that the Great Western Railway, by far the largest user of diesel cars in this country, operated daily services with A.E.C. cars over a route mileage of 760. He thought that far too much weight was attached by Mr. Bush to the question of exactly synchronising the two power units of a double-engined car; no trouble had been experienced on the G.W.R., and they had no complicated mechanism of the type which Mr. Bush had illustrated,

Mr. Bush was taken to task by Mr. Brian Reed for his statement that nickel cast iron was the usual material for crankcases for railcar oil engines up to 300 b.h.p. Particulars of 26 engines in this category which Mr. Reed had before him showed that only six engines incorporated this material whereas 15 had light alloy cases and four had welded steel. The same speaker said that no mention had been made of multi-cylinder Vee engines the highest development of railcar units. Ten different engines of this type varying in power from 330 to 600 b.h.p. showed averages of 1,540 r.p.m., 14·5 lb. per b.h.p. weight, 86 lb. per sq. in. brake m.e.p., and 1,750 ft. per min. piston speed. To a criticism by Mr. Reed that the paper on transmissions made no mention of the electric or hydraulic types and that all the best known types of geared drive were covered in a couple of lines (*e.g.*, Maybach, Mylius, and S.L.M.) or were not mentioned at all (*e.g.*, Renault, Ganz, Fiat, T.A.G.), Mr. Geoffrey Wilson, who was deputising for his father in the reading of the paper, made the strange reply that the title of the paper was "Mechanical Transmissions." Obviously he had not been told that the occasion was a *symposium* on railcars, and that the terms of reference for the section as given by the Institution of Automobile Engineers included the title "Transmission."

An excellent point for the more extensive use of railcars in this country was made by Mr. Webber, of the Iron Trades Federation, who congratulated the L.N.E.R. on taking him from London to Darlington, 232 miles, in 3 hr. 18 min., but wondered why, when he got there, the next hour and a quarter should be spent in getting to Saltburn, barely 28 miles further. He thought a railcar run in connection with the Silver Jubilee would obviate this objection. Mr. Devlin thought that the side drive used on the A.E.C. cars was merely a copy of a system evolved by Dr. F. W. Lanchester, and that although it had been hailed as something quite new, it was about 25 years old. This speaker also thought that the railcar engine of the future would be of the medium-speed medium-weight type, but it is difficult to reconcile this with ordinary progress, and it was emphatically refuted in the reply to the discussion. But Mr. Devlin appeared to be out of date with his information, for he spoke of the double-crankshaft engine as being the latest thing in Germany, whereas it was given up for new construction about a year ago, after figuring on the delivery list for merely a year, single crankshaft designs of the same power and slightly less weight having been found more satisfactory. The discussion was closed by Sir Philip Dawson, who said that while full electrification must be considered the solution for suburban work, there was a big field for the self-contained railcar in this country.

MAYBACH GEARS.—A company known as Maybach Gears Limited has been formed to exploit in this country the various forms of Maybach gearboxes and change-speed gears suitable for private cars, commercial road vehicles, and railcars. Mr. Ernst Schneider, the present Maybach agent in this country, will be in charge of the organisation, and from March 25 the address will be Lincoln House, High Holborn, London, W.C.1.

NOTES AND NEWS

Diesel Railcar for Wales.—On March 16 the Great Western Railway began a service in the Tenby–Carmarthen–Llanelly–Swansea area with one of the new A.E.C.-engined 260 b.h.p. diesel-mechanical railcars. This brings the total number of G.W.R. daily diesel services up to 102.

Metallurgical Laboratory.—Lest it be thought from the paragraph on page 380 of the issue of this Supplement for February 21, that the new laboratory added by High Duty Alloys Limited to its works at Slough was the first of its kind at that establishment, we would say that it formed an extension of the large existing chemical and metallurgical laboratory, which actually formed the nucleus of the works.

New Ruston Licence.—Ruston & Hornsby Limited have completed a licence agreement with the Hercules Motor Corporation, of Canton, Ohio, for the building in England of that organisation's light-weight high-speed oil engines, which in this country will be known as the Ruston (Hercules type) engine.

Ganz Licensee in France.—The Société Als-Thom has taken out a French licence for the construction of Ganz diesel engines, and has obtained an order from the P.O.–Midi Railway for two railcars, each to be powered by two 220–275 b.h.p. engines of Ganz design, with electric transmission.

Mogyana Railcars.—In describing the type of bogie being fitted to the new Mogyana Railway diesel cars on page 374 of our February 21 issue, we mentioned that this, and also the type of articulation, is similar to that used with success on the Great Northern Railway (Ireland) and the County Donegal railcars. Actually, this type of construction was evolved by Walker Bros. (Wigan) Ltd., in conjunction with Mr. D. N. McClure, of the Clogher Valley Railway, and subsequently elaborated for other cars built in conjunction with Mr. G. B. Howden, of the Great Northern Railway of Ireland, and Mr. Henry Forbes, of the County Donegal Railways.

German Diesel Record.—With reference to the paragraph on page 368 of the February 21 issue of this supplement, recording a speed of 200 km.p.h. (124 m.p.h.) as having been attained by a German diesel train, we have received a note from Mr. Ernst Schneider, the Maybach agent in Great Britain, that the actual speed attained by this train (a 1,200 b.h.p. Maybach-engined set, as we surmised in the above paragraph) was 205 km.p.h. (127·2 m.p.h.).

A New Irish Diesel Locomotive.—The Belfast & County Down Railway has placed an order with Harland & Wolff Limited for the construction of a 500 b.h.p. diesel-electric locomotive which will be powered by a two-stroke Harland Burmeister eight-cylinder engine running at 800 r.p.m. The engine will be direct-coupled to the d.c. generator, and this and the remainder of the electrical equipment will be on similar lines to that of the 270 b.h.p. locomotive which has been at work for the past two and a half years. The new locomotive has been designed for use on the Ardglass branch, which is eight miles in length and has 1 in 50 grades and severe curves. The continuous tractive effort will be 10,000 lb. at 12 m.p.h., and at the maximum speed of 50 m.p.h. the tractive effort will be 2,900 lb. A dead-man handle is to be incorporated in the control to cut off power and apply the vacuum brake, and in place of electric heating of the carriage stock, as with the present locomotive, a Clarkson exhaust-gas boiler will be fitted. The locomotive is being built to the requirements of Mr. John L. Crosthwait, the company's Locomotive Engineer, who was responsible for the design of the 270 b.h.p. unit.

America's latest high-speed air-conditioned oil-electric train

New Streamliner for the Illinois Central Railroad

A five-car 1,200 b.h.p. streamlined articulated oil-electric train has just been built for the Illinois Central Railroad by the Pullman Car & Manufacturing Company at a cost of about £80,000. It is to be used between Chicago and St. Louis, and the proposed timetable gives an average speed of slightly over 60 m.p.h.

The train consists of a power car, combined baggage, mail and express car, two chair cars and a lounge car, the last named with an electrically-equipped kitchen and mechanical refrigeration. Portable dining tables are available for use in the lounge car and the chair car seats have collapsible tables for the service of meals. Air-conditioned throughout, the new train weighs about 220 Engl. tons, and has accommodation for 150 passengers in an overall length of 330 ft. The body framing is of Cor-Ten (chromium-copper-silicon) steel, which has a high resistance to corrosion combined with a fairly high tensile strength; the body panels are made of aluminium.

ILLINOIS CENTRAL LOCOMOTIVES.—The first of the three high-power oil-electric transfer locomotives ordered by the Illinois Central has been delivered. This is the unit with two 900 b.h.p. Ingersoll-Rand engines and G.E.C. electric transmission.

TEN DIESELS FOR THE U.S.A.—The New York, New Haven & Hartford Railway has placed an order with the Cooper-Bessemer Corporation for five 600 b.h.p. diesel-electric switching locomotives, and with the Ingersoll-Rand Company for five similar units.